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Centro Nacional de
Investigaciones Metalurgicas

CSIC

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informe n.° 101-G

asunto:

ASESORIA AL CENTRO DE INVESTIGACIONES SIDERURGICAS EN LA PRODUCCION DE FERROALEACIONES

INFORME FINAL. CONTRATO Nº. 91/101 G

peticionario: ONUDI

ASESORIA AL CENTRO DE INVESTIGACIONES SIDERÚRGICAS EN LA PRODUCCIÓN DE FERROALEACIONES. | **101-G**

INFORME FINAL. CONTRATO Nº. 91/101 G

EL PRESENTE INFORME HA SIDO EFECTUADO POR EL CENTRO NACIONAL DE INVESTIGACIONES METALÚRGICAS Y CONSTA DE:

.............21 págs
..............6 Anexos

EL DIRECTOR

Dr. Ing. D. Miguel P. de Andrés

CENTRO NACIONAL DE INVESTIGACIONES METALÚRGICAS

CIUDAD UNIVERSITARIA   CENIM   28040 MADRID

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PLANTEAMIENTO

La ONUDI ha solicitado al Centro Nacional de Investigaciones Metalúrgicas de España (CENIM), la prestación de servicios técnicos y tecnológicos para apoyar el desarrollo de la actividad metalúrgica de la UNIMET del Ministerio de la Industria Sidero-Mecánica de la República de Cuba, en los aspectos relacionados con la obtención de ferroaleaciones a partir de materias primas nacionales, utilizables en la producción de aceros inoxidables y la capacitación de técnicos en dicha esfera.

A tales efectos el CENIM ha organizado el trabajo de la siguiente forma:

1. Análisis y evaluación de conjunto con los técnicos cubanos, de los trabajos realizados en Cuba relacionados con la producción de ferroaleaciones con materias primas domésticas.
2. Estudio bibliográfico sobre la producción de ferroaleaciones base cromo y el uso del plasma en la misma.
3. Realización de pruebas de laboratorio para la obtención de ferroaleaciones en el horno de plasma térmico de 120 kW del CENIM.
4. Organización y realización de actividades de entrenamiento en la técnica del plasma térmico para los técnicos cubanos, así como gira de estudios por diferentes plantas productoras de ferroaleaciones en Europa.

En este informe se presentan los trabajos realizados correspondientes a los puntos 2, 3 y 4. En el Anexo 6 se adjunta copia del informa preliminar.

1. Introducción

En Cuba existen yacimientos de cromita que se utilizan en la fabricación de materiales refractarios. Se plantea la posibilidad de utilizar esta cromita en la fabricación de ferroaleaciones, que serán utilizadas en la producción de aceros especiales, lo que permitirá la disminución de sus importaciones por parte del gobierno cubano.

Se recoge en el presente Informe los resultados de un Proyecto de Investigación, patrocinado por la ONUDI, para la obtención de ferroaleaciones a partir de minerales cubanos. Este proyecto ha sido realizado en colaboración entre personal especializado del Centro de Investigaciones Siderúrgicas (CIS) y de la Unión Metalúrgica (UNIMET) de Cuba y del Centro Nacional de Investigaciones Metalúrgicas (CENIM) de España.

La parte experimental se ha realizado en un horno de plasma de 120 kW, instalado en el CENIM, habiéndose obtenido ferroaleaciones con base cromo.

2. Obtención de ferrosilicocromo en un horno de plasma de 120 kW

Las ferroaleaciones son las aleaciones de hierro con cromo, silicio, manganeso, tungsteno y otros elementos. Se emplean en la fabricación del acero para mejorar sus propiedades y alearlo. Conviene introducir en el acero un elemento deseable no en forma de un metal puro sino en forma de su aleación con hierro, puesto que esto es, en primer lugar, más cómodo debido a una temperatura más baja de fusión y, en segundo lugar, más ventajoso, ya que el costo del elemento principal en aleación con hierro es más bajo en comparación con el metal técnicamente puro.

Los ferroaleaciones se obtienen reduciendo los óxidos de metales respectivos. Para producir cualquier aleación hace falta elegir un reductor correspondiente y crear las condiciones que permitan extraer en alto grado de elemento costoso (principal) a partir de la materia prima que se transforma.

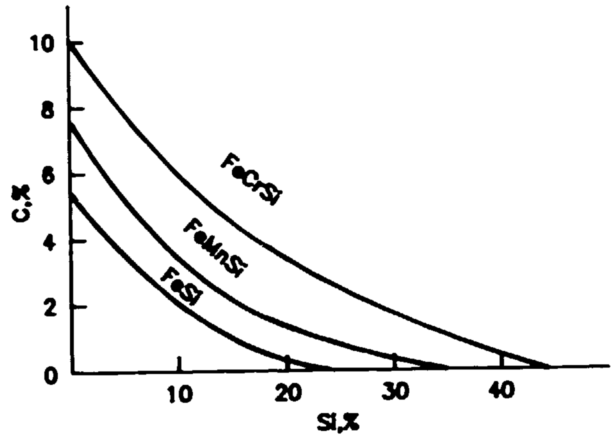
El ferrosilicocromo, FeCrSi, se obtiene por reducción carbotérmica con coque de una mezcla de cromita y cuarcita. La reducción se utiliza en un horno eléctrico según técnicas habituales (1-4) y métodos recientes patentados (5-6). En el presente trabajo se utiliza un horno de plasma para la reducción, lo que constituye una innovación.

La cromita, $FeO.Cr_2O_3$, (también $FeCr_2O_4$) es una espinela que en la naturaleza se presenta como una mezcla descrita por la fórmula $(Fe^{2+},Mg)O.(Cr,Al,Fe^{3+})_2O_3$. El mineral cromita raramente contiene más que el 50% de Cr_2O_3.

Un 80% de los minerales de cromita son finos (<10 mm) que es necesario aglomerar por sinterización, peletización o briqueteado previa a su carga al horno eléctrico. Con el proceso en plasma, que permite tratar finos, se evita esta etapa de la aglomeración, lo que constituye una mejora inicial.

El agente reductor generalmente es coque que debe presentar unos contenidos bajos en azufre y fósforo.

Se ha realizado un análisis termodinámico de las reacciones de reducción carbotérmica de $FeO.Cr_2O_3$ y SiO_2. Se forman inicialmente a las temperaturas de reacción más bajas los carburos con un contenido elevado en carbono, y a temperaturas más elevadas estos carburos reaccionan con Cr_2O_3 para formar carburos con un contenido menor en carbono; finalmente, la reducción de SiO_2 comienza a temperatura más alta. Por lo tanto, la producción de aleaciones de ferrosilicocromo requiere alta temperatura. La solubilidad del carbono en la aleación de FeCrSi depende del contenido en silicio como se puede apreciar en la figura; si el contenido de silicio es más elevado el contenido de carbono será más bajo.



Solubilidad aproximada de carbono en ferroaleaciones

El FeCrSi comercial contiene carbono como un elemento constituyente a causa de la alta afinidad del cromo por el carbono utilizado en el proceso de reducción. El silicio también presenta afinidad por el carbono, aunque en menor grado que el cromo, siendo el carburo de silicio menos estable que los carburos de cromo.

3. Esquema de reacciones de fusión carbotérmica

La cromita y la sílice se reducen carbotermicamente según una serie de reacciones muy endotérmicas que se desarrollan simultáneamente en distintos grados [7]. Para la cromita:

			Temperatura de equilibrio, ºC
$FeO.\ Cr_2O_3 + C$	$\rightleftarrows$	$Fe + Cr_2O_3 + CO$	670
$Cr_2O_3 + 4/3\ C$	$\rightleftarrows$	$2/3\ Cr_3C_2$ muy carburado $+ 3CO$	1150
$27Cr_3C_2 + 5Cr_2O_3$	$\rightleftarrows$	$13Cr_7C_3$ menos carburado $+ 15CO$	1190
$3Cr_7C_3 + Cr_2O_3$	$\rightleftarrows$	$Cr_{23}C_6$ menos carburado $+ 3CO$	1530
$1/2Cr_{23}C_6 + Cr_2O_3$	$\rightleftarrows$	$27/2\ Cr + 3\ CO$	1810

Para la sílice:

$SiO_2 + 3C$	$\rightleftarrows$	$SiC + 2CO$	1480
$2SiC + SiO_2$	$\rightleftarrows$	$3Si + 2CO$	1710

Se observa que se necesita una alta temperatura para realizar el proceso.

Los óxidos MgO y Al_2O_3 que se integran en la estructura de la cromita (Fe, Mg) O. (Cr, Al, Fe)$_2O_3$, son muy estables y pasan como tales a la escoria.

Tambi :n se pueden considerar las siguientes reacciones señaladas en un trabajo de laboratorio sobre la reducción carbotérmica de dos tipos de cromita utilizando cinco reductores sólidos, en el intervalo de temperaturas de 1100 a 1500ºC [8]:

$FeO.Cr_2O_3+17/3\ C$ -----> $1/3\ Fe_3C+2/3Cr_3C_2+4CO$

$FeO.Cr_2O_3 + 16/3\ C$ ---> $Fe + 2/3\ Cr_3C_2 + 4O$

habiéndose encontrado en los agregados de fase (phase assemblages) identificados las fases $(Fe,Cr)_3C$; $(Fe,Cr)_7\ C_3$; $(Fe,Cr,Si)_3C$; $(Fe,Cr,Si)_7C_3$ y $(Fe,Cr,Si)_{23}C_6$

Según las condiciones de reacción se puede obtener una aleación de ferrosilicocromo no estandarizada denominada carga cromo, de composición, en t%, Cr = 53-58; C = 5-8; Si=6-3 y Fe hasta balance, o bien un ferrosilicocromo estandard ISO 5449 y DIN 17565 con 12 composiciones diferentes, desde FeCrSi 15 (55% Cr mínimo, 10-18% Si; 6% C máximo; 0,050% P max; 0,030 % S max) hasta FeCrSi 50 (20% Cr min; 45-60 % Si; 0,1% C max; 0,030% P max; 0,030 % S max.)

4. Parte Experimental

Los ensayos fueron realizados en un horno de plasma de 120 kW con arco transferido. El elemento principal de este equipo es una antorcha no consumible dotada de la posibilidad de movimiento de precesión.

La antorcha y los equipos necesarios para su alimentación con corriente continua, refrigeración, control automático, etc, fueron suministrados e instalados por Tetronic Research and Development.

La figura 1 muestra la planta piloto que contiene el horno de plasma, cuyo esquema se ofrece en la figura 2.

Fig.1. Planta piloto del horno de plasma térmico de 120 kW

1. Cuarto de control
2. Rectificadores
3. Horno
4. Antorcha
5. Sistema de alimentación de la carga
6. Sistema de extracción de gases
7. Medidores del caudal de fluidos
8. Sistema de depuración del agua de refrigeración

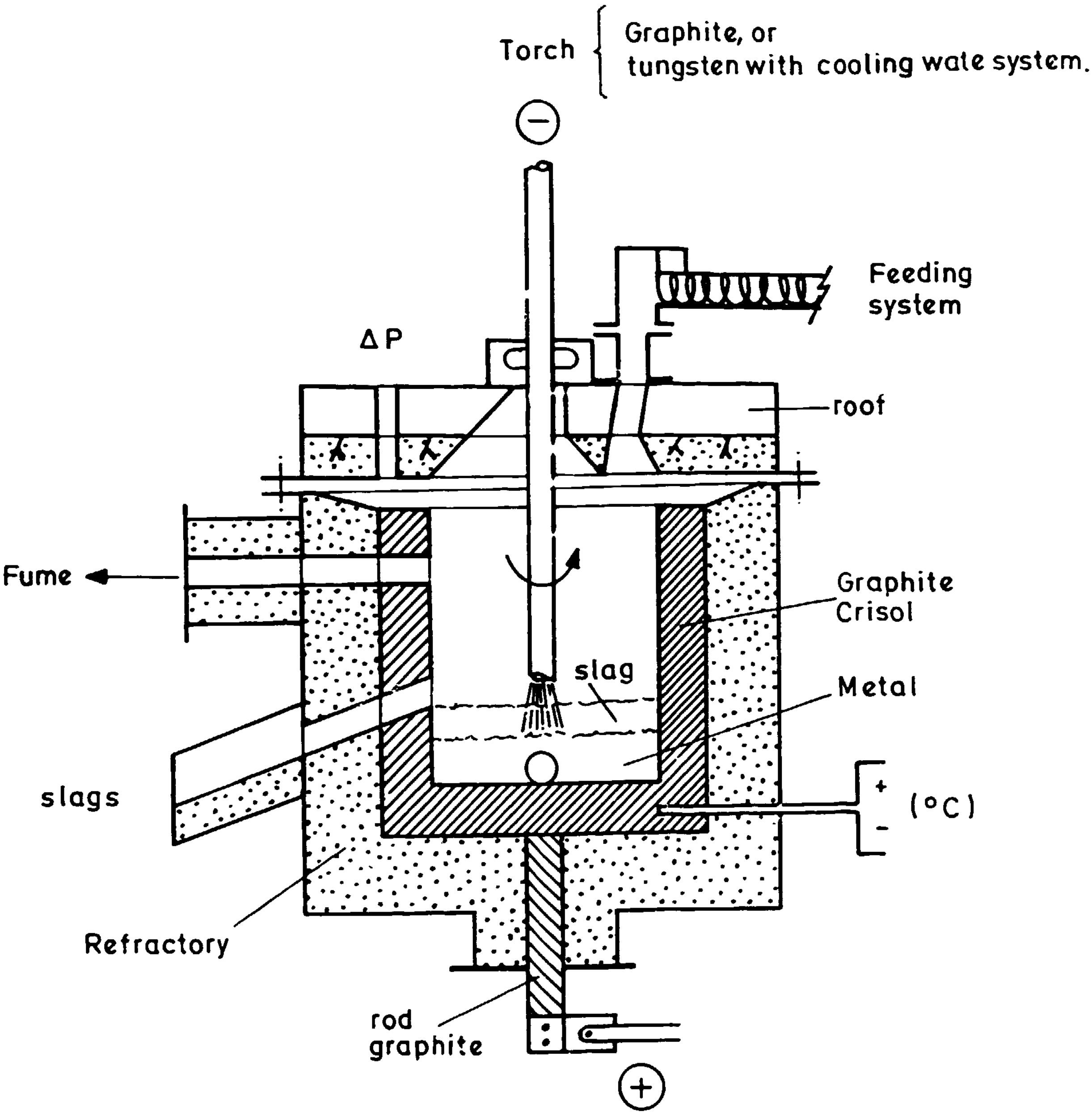


FIG 2 SCHEMA OF PLASMA FURNACE

El horno tiene un crisol de grafito de 28 litros, provisto de orificios para aspiración de gases y para salidas de metal y escoria. En el fondo y en la pared del crisol están instalados termopares. La bóveda del horno está refrigerada y tiene orificios para el paso de la antorcha, carga de materiales y observación del baño o registro de temperatura. En el extremo de la antorcha se encuentra el cátodo de wolframio toriado. Esta soldado a un tubo de cobre refrigerado por agua y protegido por otro tubo de doble pared también refrigerado. Por el espacio anular entre ambos tubos circula argón como gas plasmógeno.

Los sistemas de control permiten el arranque automático, señalizan el estado de la instalación y bloquean el funcionamiento cuando se detecta el fallo de algún elemento esencial.

Los materiales utilizados en los ensayos de fusión carbotérmica realizados en el horno de plasma, se indican en la tabla 1. Como agente reductor se ha utilizado coque de composición: 87,23% C fijo; 1,13% volátiles y 11,64% cenizas.

TABLA 1. Análisis químico de los materiales utilizados, % en peso

	Fe total	CaO	MgO	Al_2O_3	SiO_2	MnO	Cr_2O_3	NiO	CoO
Cromita	14,45	0,41	19,42	30,73	2,91	0,24	34,51	--	--
Serpentina	11,0	2,8	29,30	5,00	35,80	--	2,35	2,61	0,80
Sílice	0,14	0,025	<0,01	<0,01	99,2	--	--	--	--
Magnesita	6,3	2,0	83,83	1,5	3,5	--	--	--	--

En la realización de cada ensayo se procedía a calentar el horno frío hasta alcanzar en el interior de la pared del crisol 1150-1200ºC. A continuación se comienza la alimentación en continuo de la mezcla del material de carga, previamente homogenizada en un tambor mezclador. La velocidad de alimentación se controla en función de la temperatura medida por el termopar insertado dentro de la base del crisol. Concluída la alimentación de la carga se continua calentando el baño fundido hasta alcanzar su total fusión y homogenización precediéndose a continuación al vaciado total del reactor, como se muestra en la figura 3.

Fig.3. Toma de muestra durante una colada

La alimentación de los materiales al horno es lateral. La antorcha en el horno está dotada de un movimiento de precesión, de forma que se pueden producir unas fuertes oscilaciones de voltaje al pasar el arco del material fundido al material sin fundir, haciendo peligrar la estabilidad del haz y favorecer su extinción. Los espesores de escoria producida agravan el problema citado. Para subsanarlo se trabaja en el horno con mayor temperatura que la necesaria en el baño fundido

5. Obtención de aleación y escoria

El horno de plasma se alimenta con unas mezclas homogenizadas de material cuyos pesos se indican en la tabla 2.

TABLA 2. Balance de materiales sólidos, kg

FUSIÓN	Material cargado	Producto Obtenido	Balance de cromo			
			Cr.en la cromita	Cr aleación	Cr escoria	Cr perdido
1	cromita 6,15 serpentina 3,33 coque 2,12	aleación 1,40 escoria N.D.				
2	cromita 14,25 sílice 7,00 coque 3,75	aleación 3,89 escoria 12,20	3,37	1,81	0,29	1,27
3	cromita 12,50 sílice 5,58 magnesita 1,50 coque 4,04	aleación 3,30 escoria 11,60	2,95	1,69	0,03	1,23
4	cromita 14,25 sílice 9,50 magnesita 2,90 coque 4,75	aleación 4,40 escoria 15,10	3,37	2,22	0,10	1,05

N.D. = no determinado

La mezcla para la fusión F1 estaba orientada para la obtención de ferrocromo y las demás mezclas para el ferrosilicocromo. En la tabla también se indican los pesos de aleación y escoria obtenidos en cada fusión, y un balance de la distribución de cromo. Se puede observar una pérdida de cromo cuya causa ha sido el arrastre del material durante su carga debido a la aspiración que se mantiene en el horno.

En la tabla 3 se ofrece la composición química de la aleación y escoria obtenidos en cada fusión. Se puede apreciar un coeficiente de reparto elevado del cromo entre la aleación y la escoria.

TABLA 3. Análisis químico de los productos obtenidos, % en peso

FUSIÓN	ALEACIÓN							ESCORIA			
	Fe	Cr	Si	C	Ni	Co	S	SiO_2	AL_2O	MgO	Cr_2O_3
1	34,09	45,92	8,48	5,40	1,31	0,066	0,0045	48,15	24,65	20,92	3,48
2	28,90	46,58	10,58	5,65	—	—	0,003	44,77	34,13	19,59	3,43
3	27,40	51,25	11,27	5,16	—	—	0,007	36,28	30,68	27,39	0,38
4	28,64	50,45	15,76	4,20	—	—	0,02	42,83	26,53	27,39	1,01

6. Ensayo de reblandecimiento y fusión

Con muestras de aleación y escoria se han realizado ensayos de reblandecimiento y fusión. Estos ensayos proporcionan información del comportamiento de los materiales durante su calentamiento en el horno. Se realiza el ensayo en un equipo LECO AF-600 con un horno que alcanza 1650ºC de temperatura máxima, en el que mediante ordenador se han fijado los siguientes parámetros: Norma ASTM, atmósfera inerte (N_2); temperaturas de comienzo y final del programa; caudal de gas y velocidad de calentamiento.

Se introducen en el horno cinco pirámides iguales, de 15 mm de altura, de muestra molida del material a ensayar colocadas en una bandeja sobre un pedestal giratorio. A medida que se eleva la temperatura y mediante un sistema de video, el equipo va almacenando información de las transformaciones que se producen en cada una de las cinco muestras. Al final del ensayo se obtiene un registro gráfico de las variaciones de altura y anchura que durante el ensayo ha experimentado cada una de las cinco muestras. Asimismo mediante impresora se obtienen las temperaturas a las que se han producido los cuatros puntos representativos:

IT = Inicio de la deformación
ST = Punto de reblandecimiento (Altura=anchura)
HT = Formación de la semiesfera (Altura=1/2 anchura)
FT = Punto de fluidez (Altura < 1,5 mm)

Los resultados obtenidos con las muestras estudiadas se ofrecen en la tabla 4.

TABLA 4. Ensayos de reblandecimiento y fusión

MUESTRA	Puntos representativos, ºC				
	IT	ST	HT	FT	FT-ST
Escoria F1	1336	1342	1355	1360	18
Escoria F2	1395	1423	1569	1640	217
Escoria F3	1382	1414	1439	1516	102
Aleación F4	1620	>1650	>1650	>1650	

Se observa como la presencia de serpentina en el material de carga favorece la obtención de una escoria con un punto de fusión bajo (escoria F1). En la otra serie de fusiones se observa como la adición de magnesita a la carga favorece la disminución de los puntos de reblandecimiento y fusión de la escoria (escoria F3). El operar con escorias de bajo punto de fusión es importante puesto que la reducción carbotérmica de la cromita se realiza en la fase escoria.

7. Estudio del ferrosilicocromo por microsonda

Con muestras de metal obtenido en las fusiones F2 y F4 se han preparado dos probetas que se pueden observar en la figura 4. Estas aleaciones se han estudiado en un microscopio electrónico de barrido con microsonda JEOL modelo JSM-840, con un analizador LINK AN-10000.

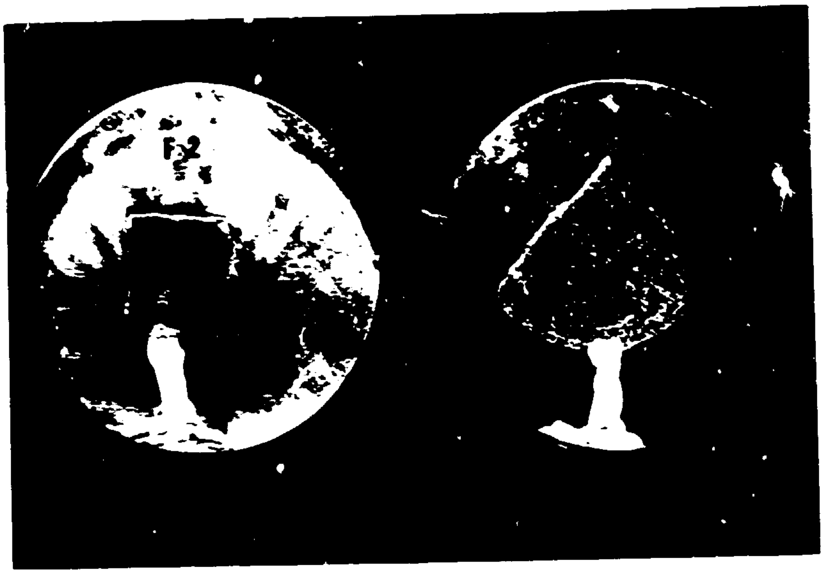


Fig. 4. Probetas de las aleaciones obtenidas en las fusiones F2 y F4 (x2)

En la figura 5 se ofrece un aspecto general de la aleación correspondiente a la fusión F2, con fases muy entremezcladas. En la figura 6 se ofrece con detalle una zona localizada en la figura anterior y se pueden distinguir tres fases: la matriz, rica en cromo como Cr_7C_3 o como $Cr_{23}C_6$, de tonalidad negra, fase dispersa 1 de tonalidad gris y la fase dispersa 2, rica en hierro y de tonalidad gris claro.

Fig. 5. Aspecto general de la aleación obtenida en la fusión F2. Se observan fases muy entremezcladas (x150)

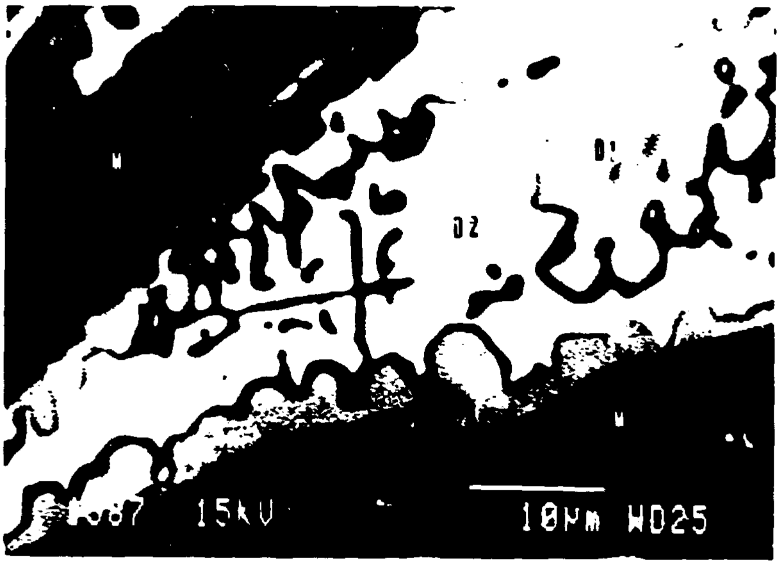


Fig. 6. Detalle de una zona localizada en la figura anterior (x2000).

M = matriz rica en carburo de cromo

D1= fase dispersa 1

D2= fase dispersa 2, rica en hierro

El análisis químico puntual de cada fase se recoge en la tabla 5. Los valores de la tabla son media de dos o tres valores del análisis realizado en dos o tres puntos distintos de esa fase, por ser estos muy próximos. El porcentaje en carbono se ha calculado por diferencia hasta completar el 100%. Los espacios en blanco indican que no se ha detectado el elemento.

TABLA 5.- Análisis químico puntual de aleaciones, % en peso

FUSIÓN	FASE	Fe	Si	Cr	Ti	Ni	P	C
F2	matriz	16,04	11,20	64,68	0,39			7,69
	dispersa 1	34,94	10,27	48,28		0,81		5,70
	dispersa 2	72,74	13,78	12,21		0,94		0,33
F4	matriz	22,58	17,81	53,66	0,38			5,57
	dispersa 1	29,46	10,01	52,53				8,00
	dispersa 2	65,41	12,73	19,89			0,77	1,20

La figura 7 corresponde a la aleación obtenida en la fusión F4. La figura 8 ofrece con detalle una zona localizada en el centro de la figura anterior, en donde se distinguen tres fases: matriz, rica en cromo como carburo; fase dispersa 1 también rica en cromo y fase dispersa 2 rica en hierro. En las figuras 8a, 8b y 8c se ofrece un mapa de distribución de cromo, silicio y hierro sobre la zona localizada en la figura 8, respectivamente. Estos mapas manifiestan el mayor o menor contenido de esos elementos en cada fase.

Fig.7. Aspecto general de la aleación obtenida en la fusión F4 (x 150)

Fig. 8. Detalle de una zona localizada en el centro de la figura anterior (x 1300)

M= matriz rica en carburo de cromo

D1=fase dispersa 1, rica en carburo de cromo

D2=fase dispersa 2, rica en hierro

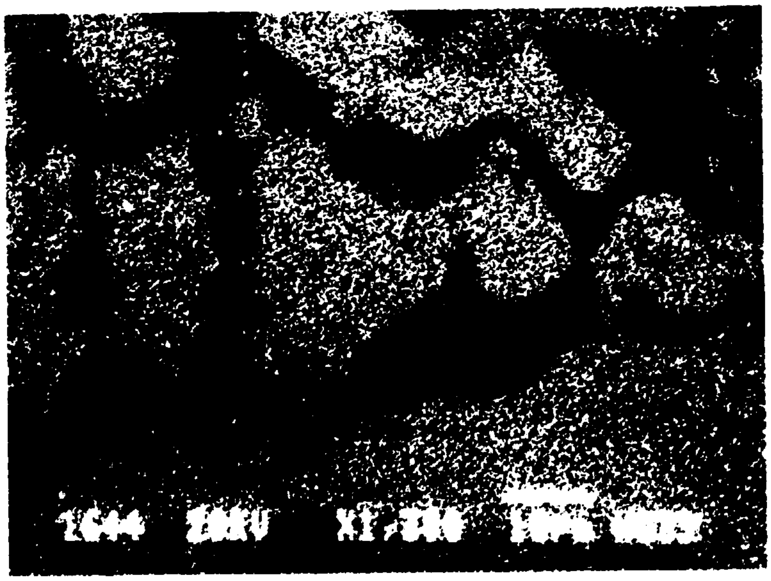


Fig. 8a Mapa de distribución de Cr

Fig. 8b Mapa de distribución de Si

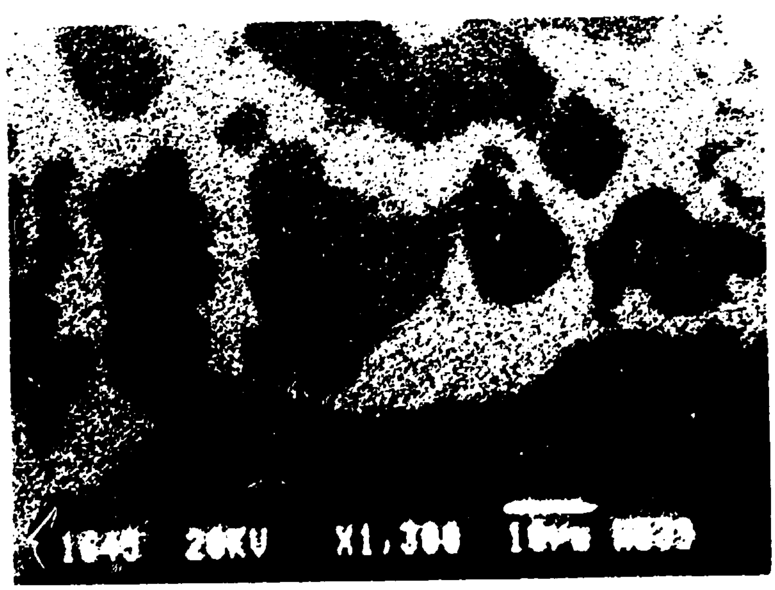


Fig. 8c Mapa de distribución de Fe

8. RECOMENDACIONES

En una serie de ensayos realizados en un horno de plasma de 120 kW, con la utilización de cromita y serpentina cubana, sílice, magnesita y coque como reductor, se han obtenido aleaciones de composición próxima al ferrocromo, en el primer ensayo, y al ferrosilicocromo en los tres ensayos siguientes. Del análisis de los resultados se considera posible, mediante un ajuste de la mezcla de alimentación y un mejor control del proceso, obtener un ferrosilicocromo según norma.

Se recomienda continuar estos trabajos a nivel de planta piloto en la instalación de plasma térmico de 120 kW, existente en el CENIM y pasar luego a mayor escala en la instalación semiindustrial de plasma térmico de 3000 kW de la empresa PRESUR, a la cual el CENIM tiene acceso, para definir mejor el proceso de reducción carbotérmica de estos materiales para fabricar ferrosilicocromo.

Se recomienda realizar ensayos en una planta piloto semiindustrial, utilizando hornos eléctricos de arco sumergido.

PARTICIPANTES

Han intervenido en la elaboración de este informe las siguientes personas:

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Madrid, Julio de 1992.

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4.- P.ROZOLIMO, C.AVRAM, R.ANCUT y C. BOIANGIN. "Researches on the determination of the manufacturing of ferrosilicochrome with high silicon content". Metalurgia (Bucharest), Jan 1988, 40 (1), 10-11.

5.- A. BORAK "Charge for production of ferrosilicochromium". Czechoslovak Patent No.: 248129

6.- V.I. ZHUCHKOV, A.L. ZAV'YALOV, S.V. LUKIN, YA.I.OSTROVSKII, YU.P.SERDITOV, YU.I.SHATOV y A.N. SHCHERBIN. "Charge for ferrosilicochromium".
Russian Patent No.: 1331899

7.- J.H. DOWNING "Theoretical basic for smelting ferroalloys". 34th Electric Furnace Conference, St.Louis, Miss, Dec., 1976.

8.- R.H. NAFZINGER, J.E. TRESS y J.I. PAIGE "Carbothermic reduction of domestic chromites". Metallurgical Transactions B, Vol. 10B, March 1979, 5-14.

ANEXOS

Anexo-1

INFORME SOBRE LA GIRA DE ESTUDIOS REALIZADA POR PLANTAS DE EUROPA EN EL MARCO DEL PROYECTO DE LA ONUDI SI/CU 90-803.

Visita a la Sociedad "BERZELIUS METALLHUETEN"

La visita a las instalaciones de la fábrica se realizó el día 14/4/92. Esta fábrica está enclavada en Stolberg, Alemania.

La fábrica está especializada en la producción de Plomo Refinado. Tiene la tecnología más moderna que existe en el mundo en estos momentos, en este tipo de producción.

El horno que ofertan y objeto de nuestra visita trabajó durante 8 meses, hasta marzo de 1991. Posteriormente fué sustituído por un horno Horizontal (reactor que funciona con quemadores de gas metano), mucho más adecuado.

El horno que se oferta es una instalación que aunque cuenta con transformador y 3 electrodos de grafito, funciona por el principio de fusión por resistencia y no por arco eléctrico. Por lo que no se presta para la fusión de ferroaleaciones, pudiera utilizarse para la fusión de escorias.

El transformador, que no ha sido desmantelado y está en buen estado tiene las siguientes características: Fábrica NATIONAL INDUSTRI.

Circuito primario 10 kv 60,7 115,5 A 50 hz(1052-2000 kva)
Circuito secundario 50 - 95 v 12155 A
Estación oleohidráulica en buen estado y sin desmantelar.
Columnas y brazos portaelectrodos desmantelados, cables flexibles en mal estado.
Torre de enfriamiento de gases de salida y recolección de polvos en buen estado.
Piezas de repuesto almacenadas en buen estado.

Conclusiones y acuerdos de la visita

- El horno ofertado no es adecuado para la fusión de ferrocromo.
- Se hizo una valoración de las partes de la instalación de posible interés (Transformador, Central oleohidráulica, Columnas y Soportes de Electrodos, Piezas de repuesto).
- La firma enviará a nuestra dirección una oferta detallada que incluirá planos y precios de las partes de interés.

Anexo-2

INFORME SOBRE LA GIRA DE ESTUDIOS REALIZADA POR PLANTAS DE EUROPA EN EL MARCO DEL PROYECTO DE LA ONUDI SI/CU 90-803.

Visita a las instalaciones de FERROALEACIONES ESPAÑOLAS, SA

La visita a esta fábrica se realizó el día 24/4/92.

En España esta fábrica está enclavada en Medina del Campo, Castilla-León y su producción principal es la de ferrocromo de alto carbono, para la cual cuenta con 4 hornos de arco eléctrico sumergido: dos de 4 MVA, uno de 7,5 y otro de 9 MVA.

Estas instalaciones "están paradas" en estos momentos, no obstante durante el recorrido pudimos conocer detalles importantes del ciclo productivo, desde las materias primas hasta la obtención del producto final.

Se hizo énfasis en los accesorios fundamentales que permiten el funcionamiento del horno como son: el transformador, disyuntor, banco de condensadores, sistema oleohidráulico para el movimiento de los electrodos, cables flexibles, punto de mando y control de operaciones, sistema de enfriamiento, plataformas de colada, de trabajo y de virolas.

Pudimos adquirir conocimientos del régimen de fusión, colada, rendimiento de metal, trituración y clasificación de los productos finales (metal y escoria).

Aunque los hornos de ferrocromo no están en funcionamiento (definitivamente parados), en la Planta de FERSA se trabaja actualmente en el desguace de baterías para la recuperación del plomo.

También se crean condiciones para la recuperación del 5% del ferrocromo contenido en las escorias almacenadas en el patio, que puede significar un total de 50.000 toneladas de dicho producto final con granulometría pequeña, pero comercializable.

Esto se logrará por trituración de la escoria y clasificación por vía húmeda.

Además de los conocimientos adquiridos, como resultado de la visita quedó materializada la disposición de la administración de FERSA de ofertar estas instalaciones a nuestro país y colaborar en la asimilación de la producción de ferroaleaciones y en particular ferrocromo.

Anexo-3

INFORME SOBRE LA GIRA DE ESTUDIOS REALIZADA POR PLANTAS DE EUROPA EN EL MARCO DEL PROYECTO DE LA ONUDI SI/CU 90-803.

Visita a las instalaciones de Prerreducidos del Sur, (PRESUR).

La visita a esta fábrica se realizó el día 28/4/92.

En España esta planta está enclavada en Fregenal de la Sierra, Extremadura.

Su producción principal actual es la de una aleación al cromo-níquel obtenida mediante la fusión de los polvos recuperados en la fábrica de aceros inoxidables ACERINOX. Para ello cuentan con un horno de tecnología de plasma de arco transferido de 3 MVA de potencia y que está funcionando sin dificultad.

Durante el recorrido por la fábrica pudimos conocer el proceso productivo en sus diferentes etapas, desde la recepción de las materias primas, almacenaje, dosificación, mezclado y alimentación al horno hasta el proceso de colada, enfriamiento y separación del metal y la escoria.

Se nos mostró todos los accesorios necesarios para el funcionamiento del horno de plasma, así como el sistema de tratamiento de los humos.

También en la fábrica pudimos ver una instalación piloto de plasma de 250 KVA que permite trabajar en regímenes de arco transferido y no transferido.

En este horno se ha investigado la fusión y recuperación de finos de cromita, polvos de acería de hierro, cromo y níquel, lodos de manganeso y chatarras especiales.

Al punto de control de esta instalación se han instalado otras antorchas en cuyos reactores se pueden investigar la destrucción por plasma de policlorobifenilos (aceites de transformadores PCBS) y residuos industriales, la gasificación del carbón vía plasma e hidrogenación para obtención de acetileno y aprovechamiento de residuos tetaníferos.

En la visita quedó establecida la disposición de la dirección de la fábrica a colaborar en nuestras direcciones de trabajo y a aportar sus instalaciones para corridas de escala piloto, lo que constituye un punto de partida para poder realizar ensayos con los minerales cubanos de cromo.

Anexo-4

E S A INFORMATION RETRIEVAL SERVICE

USER 010976 DATE:01/20/92 TIME:10:05:11

PRINT SUMMARY

NO.	FILE	ACCN/SET	FMT	ITEM-RANGE	COPY#
1	2	36	A	..-80	1

SEARCH HISTORY

SET	ITEMS	DESCRIPTION
1	15716	LA=SPAN
2	147530	LA=GER
3	458753	LA=JAPAN
4	606270	2+3
5	20	FERROCHROME/TI
6	0	FERROCHROMENICKEL/TI
7	0	FERROCHROME(W)NICKEL/TI
8	0	FERROCHROME(W)NICKEL/CT
9	0	FERROCHROME(W)NICKEL
10	0	FERROCHROMENICKEL
11	280	FERROMANGANESE/TI
12	0	FERROSILICOCHROME/TI
13	0	FERROSILICOCHROME
14	0	FERRO(W)SILICO(W)CHROME
15	826	FERROSILICO?
16	27	FERROSILICOCHR?
17	10	FERROSILICOCHROM?/TI
18	170	FERROCHROM?/TI
19	0	FERROCHROMENICKEL/TI
20	0	FERROCHROM?(W)NICKEL/TI
21	3	FERROCHROM?(W)NICKEL
22	425	FERROCHROMIUM
23	9142	NICKEL(W)ALLOY
24	5	22*23
25	68508	NICKEL
26	25	22*25
27	47457	PRODUCTION/TI
28	67219	MANUFACTURE/TI
29	114510	27+28
30	34	11*29
31	65	18*29
32	10	17-4
33	14	26-4
34	16	30-4
35	40	31-4
36	80	32+33+34+35

SRCH TIME 37.42 PRINT COUNT 80 [illegible] 60

Quest Accession Number : 15260353
115(24)260353 CHEMABS patent
Recovery of gallium and zinc as volatiles from fume condensate obtained in manufacture of ferrochromium
Kornelius, Gerrit
S. Afr. ZA
S. African; (910626) P 12 pp.; In Eng; Coden: SFXXA;
Pat. No.: 90 07103; Int. Class: C22B-000/ A; Doc. Code: A;
Appl.: ZA 90/7103 900906;
Priority Appl.: ZA 89/6828 890907;
Sections: 154002
Registry No.: 630-08-0 reactions <reduction with, of smelt_ng fume pellets, gallium and zinc recovery by vaporazing in>; 7440-44-0 reactions <*>; 7440-55-3 preparation <recovery of, from smelting fume, heating under reducing atmosphere for vaporization and>; 7440-66-6 preparation <*>· 11114-46-8 <manufacture of, gallium and zinc in fume from, recovery by reduction and vaporization of>
Mol. Formula: CO; Ga; Zn; C.Cr.Fe.N.Si
Terms: ferrochromium smelting fume reduction / zinc separation smelting fume reduction / gallium separation smelting fume reduction
CT: CHARCOAL,<reduction with, of smelting fume pellets, gal..ium and zinc recovery by vaporazing in>/FLUE DUST,<smelting, gallium and zinc recovery from, by heating under reducing atmosphere>/nonbase/base/compounds

Quest Accession Number : 15163600
115(16)163600 CHEMABS conference
Kinetic study of transference of iron-chromium, iron-niob..um, and iron-titanium in liquid solutions of iron-chromium-nickel alloys
Tapia, O.; Benda, M.; Klimek, K.; Michalek, K.; Salva, O.
Inst. Tecnol. Morelia Mex. MX
Document type: CONFERENCE; Congr. Nac. Cienc. Tecnol. Meta..., 7th; (90) P 1-8; Vol 3,; In Span; Coden: 57BVA; Publisher: Cent. Nac. Invest. Metal., Madrid, Spain;
Sections: 155001
Registry No.: 12597-68-1 uses and miscellaneous <manufacture of, ferroalloy dissolution in melt during, kinetics of>; 136360-22-0 <alloying of molten, with ferroalloys, kinetics of>; 136360-23-1 <*>; 136360-24-2 <alloying with, of molten iron chromium nickel alloys, kinetics of>; 136360-25-3 <*>; 136360-26-4 <*>; 136360-27-5 <*>; 136360-28-6 <*>
Mol. Formula: W99; Fe.Ni; Cr.Fe.Ni; Cr.Fe.Mn.Si; C.Al.Fe.Mn.Nb.P.Si.Ta.Ti; C.Al.Fe.Mn.Si.Ti; Al.Fe.Mn.Si.Ti; C.Al.Fe.Mn.Si.Ti
Terms: ferrochromium alloying iron nickel melt / ferroniobium alloying iron nickel chromium / ferrotitanium alloying iron nickel chromium / stainless steelmaking ferroalloy addition kinetics
CT: base/nonbase

Quest Accession Number : 15078143
115(08)078143 CHEMABS journal
Mineralogical and chemical studies of wastes from the manufacture of ferrochromium as illustrated by the Siechnica Steelworks
Chodyniecka, Lidia; Pozzi, Marek
Politech. Slaska Gliwice Pol. PL
Zesz. Nauk. Politech. Slask., Gorn.; (90) P 79-95; Vol 187,; In Pol; Coden: ZNSGA; ISSN: 0372950;
Sections: 160006 / 104 / 156
Registry No.: 1303-86-2 uses and miscellaneous <in ferrochromium manufacturing wastes>; 1305-78-8 uses and miscellaneous <*>; 1309-37-1 uses and miscellaneous <*>; 1309-48-4 uses and miscellaneous <*>; 1310-14-1 <*>; 1313-99-1 uses and miscellaneous <*>; 1314-1_-0 uses and miscellaneous <*>; 1314-13-2 uses and miscellaneous <*>; 1317-36-8 uses and miscellaneous <*>; 1317-38-0 uses and miscellaneous <*>; 1333-82-0 <*>; 1344-28-1 biological studies <*>; 1344-43-0 uses and miscellaneous <*>; 1345-25-1 uses and miscellaneous <*>; 7439-89-6 uses and miscellaneous <metallic, in ferrochromium manufacturing wastes>; 7440-47-3 uses and miscellaneous <hexavalent, in ferrochromium manufacturing wastes>; 7446-11-9 uses and miscellaneous <in ferrochromium manufacturing wastes>; 7631-86-9 uses and miscellaneous <*>; 11114-46-8 <manufacture of, wastes from, mineralog and chemical composition of>; 13397-24-5 uses and miscellaneous <in ferrochromium manufacturing wastes>; 13397-26-7 uses and miscellaneous <*>; 13463-67-7 uses and miscellaneous <*>; 13596-18-4 <*>; 14284-23-2 <*>; 14808-60-7 uses and miscellaneous <*>; 15490-99-0 <*>
Mol. Formula: B2O3; CaO; Fe2O3; MgO; FeHO2; NiO; OSr; OZn; OPb; CuO; CrO3; Al2O3; MnO; FeO; Cr; O3S; O2Si; C.Cr.Fe.N.Si; H2O4S.Ca.2H2O; CH2O3.Ca; O2Ti; H4O4Si.3/2Ca.1/2Mg; H4O4Si.2Ca; O2Si; C12H6O12.2Al.xH2O
Terms: ferrochromium waste mineral chemical composition
CT: SLAGS,<from ferrochromium manufacture , mineralog and chemical composition of>/WASTE SOLIDS,<from ferrochromium manufacture , mineralog and chemical composition of>/nonbase/base/compounds

Quest Accession Number : 15012874
115(02)012874 CHEMABS journal
Production of low-chromium cast iron by injecting ferrosilicochromium into the melt
Warchala, Tadeusz; Borkowski, Stanislaw
Politech. Czestochowska Pol. PL
Przegl. Odlew.; (90) P 120-2; Vol 40; No 4; In Pol; Coden: PRZOA ; ISSN: 0033227;
Sections: 155001
Registry No.: 11133-78-1 <injection of, to cast iron melt, with air> ; 134489-19-3 <production of, by injecting ferrosilicochromium to melt with air>
Mol. Formula: C.Cr.Fe.Si; C.Cr.Fe.Mn.Si
Terms: cast iron injection ferrosilicochromium air
CT: nonbase/base

Quest Accession Number : 14211158
114(22)211158 CHEMABS patent
Smelting charge for high-carbon ferromanganese manufacture
Shchedrovitskii, V. Ya.; Kucher, A. G.; Velichko, B. F.; Koval, A. V.; Kucher, I. G.; Tkach, G. D.
Bardin, I. P., Central Scientific-Research Institute of Ferrous Metallurgy
USSR SU
From: Otkrytiya, Izobret. 1990, (47), 95.
U.S.S.R. ; (901223) In Russ; Coden: URXXA;
Pat. No.: 1615213; Int. Class: C22C-033/04 A; Doc. Code: A1;
Appl.: SU 4477826 880722;
Sections: 154002
Registry No.: 1305-78-8 uses and miscellaneous <flux containing , ferromanganese from smelting charge with>; 1309-37-1 uses and miscellaneous <*>; 1309-48-4 uses and miscellaneous <*>; 1344-28-1 uses and miscellaneous <*>; 7631-86-9 uses and miscellaneous <*>; 7789-75-5 uses and miscellaneous <*>; 12604-53-4D <manufacture of, lime fluorspar flux in smelting charge for>; 14542-23-5 uses and miscellaneous <flux containing , ferromanganese from smelting charge with>
Mol. Formula: CaO; Fe2O3; MgO; Al2O3; O2Si; CaF2; C.Fe.Mn.P.Si; CaF2
Terms: ferromanganese smelting flux lime fluorspar / manganese ore smelting flux
CT: LIMESTONE,uses and miscellaneous,<flux containing , ferromanganese from smelting charge with>/nonbase/base

Quest Accession Number : 14147678
114(16)147678 CHEMABS patent
Recovery of chromium from electroplating sludges by smelting with ferrochromium manufacture
Nyirfa, Jozsef
Ipari Technologiai Intezet
Hung. HU
Hung. Teljes; (900928) P 9 pp.; In Hung; Coden: HUXXB;
Pat. No.: 53155; Int. Class: C22B-034/32 A; Doc. Code: A2;
Appl.: HU 89/818 890220;
Sections: 154002 / 172
Registry No.: 7429-90-5 reactions <reduction by, of electroplating sludge with chromium, alloy smelting in>; 7440-21-3 reactions <*>; 7440-47-3 preparation <recovery of, from electroplating sludge, smelting in>; 8049-17-0 <reduction by, of electroplating sludge with chromium, alloy smelting in>; 11114-46-8 <manufacture of, from electroplating sludge, smelting for>; 11133-78-1 <*>
Mol. Formula: Al; Si; Cr; W99; C.Cr.Fe.B.Si; C.Cr.Fe.Si
Terms: chromium recovery sludge smelting / electroplating sludge smelting / ferrochromium smelting sludge
CT: LIME,chemical,<flux, chromium containing sludges and, for ferroalloy manufacture>/WASTE SOLIDS, chromium containing , smelting of, for ferroalloy manufacture>/base/nonbase/compounds

Quest Accession Number : 13217195
113(24)217195 CHEMABS journal
Occupational dermatoses in workers of shops for separation of slags in the production of low-carbon ferrochrome
Podkin, Yu. S.; Zaslavskii, A. K.; Varzina, N. V.
Inst. Gig. Tr. Profzabol. Kozhno-Venerol. Inst. Sverdlovsk USSR SU
Gig. Tr. Prof. Zabol.; (90) P 20-3; No 1; In Russ; Coden. GTPZA; ISSN: 0016991;
Sections: 159005 / 104 / 155
Registry No.: 11114-46-8 <low carbon, manufacture of, occupational dermatoses in slag separation workers in>
Mol. Formula: C.Cr.Fe.N.Si
Terms: occupational dermatosis ferrochrome manufacture slag / health hazard ferrochrome manufacture
CT: DERMATITIS,allergic,<in humans, from occupational exposure in slag separation in low carbon ferrochrome manufacture>/DERMATITIS,contact,<in humans, from occupational exposure in slag separation in low carbon ferrochrome manufacture>/DERMATITIS,epi-,<in humans, from occupational exposure in slag separation in low carbon ferrochrome manufacture>/HYGIENE,industrial,<in low carbon ferrochrome manufacture , occupational dermatoses from exposure in slag separation in relation to>/SKIN,occupational,disease or disorder,<of humans, in slag separation in low carbon ferrochrome manufacture>/SLAGS,<from low carbon ferrochrome manufacture , occupational dermatoses from exposure in separation of>/nonbase/base/compounds

Quest Accession Number : 13215651
113(24)215651 CHEMABS journal
Chromium balance in the production of high-carbon ferrochromium
Ponomarenko, Yu. G.; Men'shenin, V. M.; Lokhankin, A. P.; Zamyslov, V. G.
USSR SU
From: Ref. Zh., Metall. 1990, Abstr. No. 8V218.
Soversh. Sortamenta i Tekhnol. Pr-va Ferrosplavov, Chelyabinsk; (90) P 95-101; In Russ; Coden: D3RAP;
Sections: 154002 / 155
Registry No.: 7440-47-3 uses and miscellaneous <in ferrochromium manufacture , balance of>; 11114-46-8 <manufacture of high carbon, chromium balance in>
Mol. Formula: Cr; C.Cr.Fe.N.Si
Terms: chromium balance ferrochromium manufacture
CT: nonbase/base/compounds

Quest Accession Number : 13195245
113(22)195245 CHEMABS patent
Smelting charge for low- and medium-carbon ferromanganese manufacture
Tolstoguzov, N. V.; Proshunin, I. E.; Selivanov, I. A.; Sigua, T. I. ; Khomasuridze, S. N.; Gabriadze, N. D.; Mosiya, D. V.
Siberian Metallurgical Institute; Institute of Metallurgy, Academy of Sciences, Georgian S.S.R.
USSR SU
From: Otkrytiya, Izobret. 1990, (30), 128.
U.S.S.R. ; (900815) In Russ; Coden: URXXA;
Pat. No.: 1585366; Int. Class: C22C-033/04 A; Doc. Code: A1;
Appl.: SU 4482184 880914;
Sections: 154002
Registry No.: 12604-53-4 <manufacture of, smelting charge containing exothermic ore briquets for>; 12743-28-1 <exothermic briquets containing , ferromanganese smelting in presence of, for high manganese yield>
Mol. Formula: C.Fe.Mn.P.Si
Terms: ferromanganese smelting briquet ore / manganese ore exothermic briquet
CT: ORE BRIQUETS,<exothermic, ferromanganese smelting in presence of, for high manganese yield>/nonbase/base

Quest Accession Number : 13175757
113(20)175757 CHEMABS journal
Improving the production of high-carbon ferromanganese
Kravchenko, G. P.; Lyuborets, I. I.; Eremeev, A. P.; Kucher, I. G.
Ukr. NIIspetstal USSR SU
Stal'; (90) P 45-7; No 6; In Russ; Coden: STALA; ISSN: 0038920;
Sections: 154002
Registry No.: 7439-89-6 preparation <scrap, ferromanganese smelting from charges containing>; 12604-53-4 <smelting of, replacement of iron ore pellets by iron scrap in>
Mol. Formula: Fe; C.Fe.Mn.P.Si
Terms: ferromanganese smelting iron scrap
CT: WASTE SOLIDS,scrap,<iron, ferromanganese smelting from charges containing>/nonbase/base

Quest Accession Number : 13118788
113(14)118788 CHEMABS patent
Manufacture of low-carbon ferrochromium with high chromium content
Kato, Masanori; Kamatani, Toshio; Nakagawa, Keiichi; Kawasaki, Kiyoshi; Yano, Yutaka
NKK Corp.
Japan JP
Eur. Pat. Appl.; (900606) P 15 pp.; In Eng; Coden: EPXXD;
Pat. No.: 371299; Int. Class: C22C-033/00 A; Doc. Code: A1;
Appl.: EP 89/120889 891110;
Priority Appl.: JP 88/285173 881111; JP 89/57174 890309; JP 89/57175 890309;
Des. Countries : DE; FR; GB;
Sections: 154001
Registry No.: 7439-89-6 uses and miscellaneous <removal of, from ferrochromium, by acid leaching>; 7440-44-0 uses and miscellaneous <ferrochromium powder containing , for nitrogen removal in vacuum>; 7647-01-0 reactions <leaching with, of nitrided ferrochromium, for iron removal>; 7664-93-9 reactions <*>; 11114-46-8 <refining of low carbon, by nitriding and acid leaching>; 129284-53-3 <manufacture of, from ferrochromium, by nitriding for powdering and acid leaching>; 129284-54-4 <*>; 129284-55-5 <*>; 129284-56-6 <*>
Mol. Formula: Fe; C; ClH; H2O4S; C.Cr.Fe.N.Si; Cr.Fe.Mn.Si.V; Cr.Fe.Mn.V
Terms: ferrochromium nitridation acid leaching / iron leaching ferrochromium / chromium master alloy manufacture
CT: CARBON BLACK,uses and miscellaneous,<ferrochromium powder containing , for nitrogen removal in vacuum>/COAL,<ferrochromium powder containing , for nitrogen removal in vacuum>/NITRIDATION,<of ferrochromium, for powdering for acid leaching for iron removal>/base/nonbase/compounds

Quest Accession Number : 13101148
113(12)101148 CHEMABS journal
Coke consumption decrease and improvement of manganese recovery from ores in ferromanganese production at the Peace Steelworks
Sabela, Wladyslaw; Gawlikowska, Anna; Khalifa, Mohamed Gamal; Chwalek, Jozef; Bromer, Jerzy
Politech. Czestochowska Czestochowa Pol. PL
Hutnik; (90) P 49-52; Vol 57; No 2-3; In Pol; Coden HUTNA; ISSN: 0018807;
Sections: 154002
Registry No.: 7440-21-3 uses and miscellaneous <in ferromanganese, smelting recovery and coke consumption in relation to>; 12604-53-4 <smelting of, in blast furnace, silicon content and slag basicity effects on>
Mol. Formula: Si; C.Fe.Mn.P.Si
Terms: silicon ferromanganese smelting coke consumption / slag ferromanganese smelting coke consumption
CT: COKE,blast-furnace,<consumption of, in ferromanganese smelting>/SLAGS,blast-furnace,<ferromanganese smelting in relation to basicity of>/nonbase/base

Quest Accession Number : 12238594
112(26)238594 CHEMABS journal
Production of low-carbon ferrochromium with minimum nitrogen content
Bezobrazov, S. V.; Ustyugov, A. A.; Akhmanaev, S. I.
USSR SU
From: Ref. Zh., Metall. 1989, Abstr. No. 12V252.
Vop. Tekhnol. i Tekhn. Perevooruzhenie Ferrosplav Pr-va, Chelyabinsk; (89) P 8-12; In Russ; Coden: D3RAP;
Sections: 154002
Registry No.: 7727-37-9 uses and miscellaneous <removal of, from low carbon ferrochromium by vacuum thermal treatment>; 11114-4- <low carbon, vacuum thermal treatment of, nitrogen removal by>
Mol. Formula: N2; C.Cr.Fe.N.Si
Terms: low carbon ferrochromium
CT: nonbase/base/compounds

Quest Accession Number : 12220905
112(24)220905 CHEMABS journal
The effect of nickel additions on the decarburization of liquid high-carbon ferrochromium
Dresler, W.
Sch. Eng. Laurentian Univ. Sudbury Can. CA ON
Trans. Iron Steel Soc.; (89) P 1-9; Vol 10,; In Eng; Coden: TISSE ;
Sections: 155008
Registry No.: 7440-02-0 uses and miscellaneous <in high carbon ferrochromium, decarburization in relation to concentration of>; 127124-68-9 <decarburization of, thermodynamic calculation of, experimental data in relation to>; 127124-69-0 <decarburization of, effect of nickel additions on>
Mol. Formula: Ni; C.Cr.Fe.Si; C.Cr.Fe.Ni.Si
Terms: high carbon ferrochromium decarburization nickel
CT: PROCESS OPTIMIZATION,<of decarburization, of high carbon ferrochromium, effect of nickel additions on>/nonbase/base

Quest Accession Number : 12162485
112(18)162485 CHEMABS journal
Ferrochrome production by smelting reduction with coal. (I). Effects of slag composition and temperature on smelting reduction of chromite ore with solid carbon
Jung, Suk Kwang; Park, Dae Gyu; Cho, Jong Min; Lee, Il Ock; Kim, Young Jun
Res. Inst. Ind. Sci. Technol. Pohang S. Korea KR 790-330
Taehan Kumsok Hakhoechi; (89) P 698-705; Vol 27; No 8; In Korean; Coden: TKHCD; ISSN: 0253384;
Sections: 154002
Registry No.: 1308-31-2 <smelting reduction of ore, with coal, temperature and slag composition effects on>; 11114-46-8 <smelting of, from chromite ore, temperature and slag composition effects on>
Mol. Formula: Cr2FeO4; C.Cr.Fe.N.Si
Terms: ferrochromium smelting reduction chromite ore / coal reduction smelting chormite ore / slag ferrochromium smelting reduction chromite
CT: COAL,<reduction by, in ferrochromium smelting from chromite ore, temperature and slag composition effects on>/KINETICS OF REDUCTION,<of chromite ore with coal, for ferrochromium smelting, temperature and slag composition effects on>/REDUCTION,<of chromite ore with coal, for ferrochromium smelting, temperature and slag composition effects on>/SLAGS,coal-combustion,<in ferrochromim smelting from chromite ore with coal>/nonbase/base/compounds

Quest Accession Number : 12122718
112(14)122718 CHEMABS journal
Low-chromium cast iron containing up to 1.5% chromium obtained by dissolution of ferrosilicochromium
Warchala, Tadeusz; Borkowski, Stanislaw
Politech. Czestochowska Czestochowa Pol. PL
Przegl. Odlew.; (89) P 141-4; Vol 39; No 4; In Pol; Coden: PRZOA ; ISSN: 0033227;
Sections: 155001
Registry No.: 11133-78-1 <injection of, to cast iron, optimization of>; 37246-03-0 uses and miscellaneous <manufacture of low , by injection of ferrosilicochromium>
Mol. Formula: C.Cr.Fe.Si; W99
Terms: chromium cast iron ferrosilicochromium injection
CT: PROCESS OPTIMIZATION,<of injection, of ferrosilicochromium, to cast iron>/nonbase/base

Quest Accession Number : 12010092
112(02)010092 CHEMABS journal
Improving the production of high-carbon ferromanganese in electric furnaces
Mironenko, P. F.; Gasik, M. I.; Ovcharuk, A. N.; Velichko, B. F.; Koval, A. V.
Dnepropetr. Metall. Inst. Dnepropetrovsk USSR SU
Stal'; (89) P 45-8; No 8; In Russ; Coden: STALA; ISSN: 0038920;
Sections: 154002
Registry No.: 12604-53-4 <manufacture of high carbon, in electric furnace, optimization of>
Mol. Formula: C.Fe.Mn.P.Si
Terms: high carbon ferromanganese electric furnace optimization
CT: FURNACES,electric,<ferromanganese manufacture in, optimization of>/PROCESS OPTIMIZATION,<of smelting, of high carbon ferromanganese, in electric furnace>/SLAGS,<basicity of, optimization of high carbon ferromanganese manufacture in electric furnaces in relation to>/nonbase/base

Quest Accession Number : 11199152
111(22)199152 CHEMABS journal
Conservation of low-carbon ferrochromium in the manufacture of alloy steels
Rzeszowski, Marek; Zielinski, Krzysztof; Dec, Marek; Pasierb, Jan; Nowosielski, Czeslaw; Wypych, Jozef; Lipcwczan, Karol; Newski, Wieslaw
Inst. Metal. AGH Krakow Pol. PL
Wiad. Hutn.; (89) P 109-13; Vol 45; No 4; In Pol; Coden: WIHUA; ISSN: 0043513;
Sections: 155001
Registry No.: 12718-23-9 uses and miscellaneous <manufacture of, in electric furnace and ladle, ferrosilicochromium finishing in>; 12773-74-9 <*>; 37245-24-2 <*>; 39302-97-1 <*>; 39467-32-8 <*>; 55336-00-0 <*>; 56524-37-9 uses and miscellaneous <*>; 60429-84-7 uses and miscellaneous <*>; 73135-29-2 <*>; 123430-10-4 <in steelmaking, finishing with, in electric furnace and ladle>; 123481-69-6 preparation <manufacture of, in electric furnace and ladle, ferrosilicochromium finishing in>; 123481-70-9 <*>; 123481-71-0 <*>; 123481-72-1 <*>
Mol. Formula: C.Cr.Cu.Fe.Mn.Ni.Si.Ti; C.Cr.Fe.Mn.Si; C.Cr.Fe.Mn.Ni.-Si; C.Cr.Fe.Mn.Mo.Si; W99; C.Cr.Fe.Mn.Mo.Ni.Si; C.Cr.Fe.Si; C.Cr.Fe.Mn.Si; C.Cr.Cu.Fe.Mn.Ni.Si; C.Cr.Cu.Fe.Mn.Ni.P.Si
Terms: ferrosilicochromium steelmaking electric furnace ladle
CT: nonbase/base

Quest Accession Number : 11101917
111(12)101917 CHEMABS patent
The addition of ferroalloy slags to iron silicate slags for the manufacture of chemical- and fire-resistant fibers
Tuovinen, Frans Heikki; Salervo, Aarno Taneli
Outokumpu Oy
Finland FI
Finn.; (890428) P 12 pp.; In Finnish; Coden: FIXXA;
Pat. No.: 78446; Int. Class: C03C-013/06 A; Doc. Code: B;
Appl.: FI 87/5237 871127;
Sections: 157006 / 154
Registry No.: 1305-78-8 uses and miscellaneous <concentration of, control of, in iron silicate containing slags, for chemical and fire resistant fibers>; 1309-48-4 uses and miscellaneous <*>; 1344-28-1 uses and miscellaneous <*>; 7439-89-6 uses and miscellaneous <*>; 7440-02-0 preparation <iron silicate containing slags from manufacture of, enrichment of, with silica, ferroalloy slags in, for chemical and fire resistant fibers>; 7440-47-3 uses and miscellaneous <concentration of, control of, in iron silicate containing slags, for chemical and fire resistant fibers>; 7440-50-8 preparation <iron silicate containing slags from manufacture of, enrichment of, with silica, ferroalloy slags in, for chemical and fire resistant fibers>; 7631-86-9 uses and miscellaneous <concentration of, control of, in iron silicate containing slags, for chemical and fire resistant fibers>; 14808-60-7 uses and miscellaneous <enrichment with, of iron silicate containing slags, ferroalloy slag addition in, for chemical and fire resistant fibers>
Mol. Formula: CaO; MgO; Al2O3; Fe; Ni; Cr; Cu; O2Si
Terms: iron silicate slag silica fiber / ferrochromium slag silica fiber / nickel smelting slag fiber / copper smelting slag fiber
CT: SLAGS,<iron silicate containing slags, enrichment with ferroalloy slags and quartz for chemical and fire resistant fibers>/SLAGS,ferroalloy,<enrichment with quartz and, of molten iron silicate containing slags, for chemical and fire resistant fibers>/SLAGS,ferrochromium,<enrichment with quartz and, of molten iron silicate containing slags, for chemical and fire resistant fibers>/SYNTHETIC FIBERS,slag,<chemical and fire resistant, from iron silicate based slags, by modification with ferroalloy slags and quartz>

Quest Accession Number : 11101916
111(12)101916 CHEMABS patent
The use of alumina- and silica-based ferrochromium slags in the manufacture of alkali- and fire-resistant fibrous materials
Tuovinen, Frans Heikki; Salervo, Aarno Taneli
Outokumpu Oy
Finland FI
Finn.; (890428) P 7 pp.; In Finnish; Coden: FIXXA;
Pat. No.: 78447; Int. Class: C03C-013/06 A; Doc. Code: B;
Appl.: FI 87/5238 871127;
Sections: 157006 / 154
Registry No.: 1309-48-4 uses and miscellaneous <concentration of, control of, in ferrochromium slag based alumina magnesia silica alkali and fire resistant fibers, alumina silica addition for>; 11114-46-8 <slags from manufacture of, alumina magnesia silica alkali and fire resistant fibers from, with controlled magnesia content>
Mol. Formula: MgO; C.Cr.Fe.N.Si
Terms: ferrochromium slag alumina magnesia silica / slag alumina magnesia silica fiber
CT: SLAGS,ferrochromium,<alumina magnesia silica fibers from, with magnesia content controlled by alumina silica addition , for spinnability>/SYNTHETIC FIBERS,magnesium aluminosilicate,<manufacture of alkali and fire resistant, from ferrochromium slags, with alumina silica mixtures for decreased magnesia content and spinnability>/nonbase/base/compounds

Quest Accession Number : 11081756
111(10)081756 CHEMABS report
Separation and recovery of metals from zinc-treated superalloy scrap
Laverty, P. D.; Atkinson, G. B.; Desmond, D. P.
Reno Res. Cent. U. S. Bur. Mines Reno USA US NV
Document type: TECHNICAL REPORT; Bur. Mines Rep. Invest.; (89) P 20 pp.; No RI 9235,; In Eng; Coden: XBMIA; ISSN: 0096192;
Sections: 154002
Registry No.: 7440-02-0 preparation <recovery of, from superalloy scrap>; 7440-47-3 preparation <recovery of, from superalloy scrap, for ferrochromium preparation>; 7440-48-4 preparation <recovery of, from superalloy scrap>; 7647-01-0 uses and miscellaneous <leaching by, of superalloy scrap, for cobalt and nickel recovery>; 11114-46-8 <preparation of, from superalloy scrap>; 12629-04-8 <scrap, cobalt and nickel recovery from>; 12773-70-5 <*>; 54425-27-3 <*>
Mol. Formula: Ni; Cr; Co; ClH; C.Cr.Fe.N.Si; C.Co.Cr.Fe.Mn.Ni.Si.Ta.Ti.W.Zr; C.Al.Co.Cr.Cu.Fe.Mn.Mo.Nb.Ni.Si.Ta.Ti.W.Zr; C.Al.Co.Cr.Hf.Mn.Mo.Ni.Ta.Ti
Terms: superalloy scrap cobalt nickel recovery
CT: METALS,preparation,<recovery of, from superalloy scrap>/WASTE SOLIDS,scrap,<superalloy, cobalt and nickel recovery from>/nonbase/base/compounds

Quest Accession Number : 11063219
111(08)063219 CHEMABS journal
Oncological danger in processing self-disintegrating slag of production of low-carbon ferrochromium
Pokrovskaya, L. V.; Zaslavskii, A. K.; Varzina, N. V.
USSR SU
From: Ref. Zh., Metall. 1989, Abstr. No. 1V122.
Prof. Bolezni Pylev. Etiol., M.; (88) P 72-6; In Russ; Coden: D3RAP;
Sections: 159005 / 104 / 156
Registry No.: 7440-47-3 biological studies <air pollution by dust containing , exposure to, cancer risk from, in low carbon ferrochromium manufacture>; 11114-46-8 <low carbon, manufacture of, self disintegrating slag from, processing of, cancer risk from>
Mol. Formula: Cr; C.Cr.Fe.N.Si
Terms: ferrochromium slag processing cancer risk / dust ferrochromium slag air pollution
CT: AIR POLLUTION,<by chromium containing dust, exposure to, cancer risk from, in low carbon ferrochromium manufacture>/BRONCHI,diseases, chronic bronchitis,<from exposure to low carbon ferrochromium slag, of humans>/DUST,<chromium containing , air pollution by, exposure to, cancer risk from, in low carbon ferrochromium manufacture>/SLAGS,<from low carbon ferrochromium manufacture , processing of, cancer risk from>/STOMACH,neoplasm,<risk of, exposure to low carbon ferrochromium slag effect on, of humans>/STOMACH,gastritis,<chronic, from exposure to low carbon ferrochromium slag, of humans>/nonbase/base/compounds

Quest Accession Number : 11061468
111(08)061468 CHEMABS patent
Manufacture of low-carbon ferrochromium
Bushuev, G. F.; Ostrovskii, Ya. I.; Serditov, Yu. P.; Shcherbin, A. N.; Kirichenko, N. F.; Naryzhnyi, V. D.; Mezyakaev, G. V.; Votyakov, A. G.; Voloshchuk, N. A.
USSR SU
From: Otkrytiya, Izobret. 1989, (17), 96.
U.S.S.R. ; (890507) In Russ; Coden: URXXA;
Pat. No.: 1477761; Int. Class: C22C-033/04 A; Doc. Code: A2;
Appl.: SU 4291545 870728;
Sections: 154002
Registry No.: 11114-46-8 <manufacture of low carbon, from ferrosilicochromium, melt treatment in>; 11133-78-1 <ferrochromium from, melt treatment for>
Mol. Formula: C.Cr.Fe.N.Si; C.Cr.Fe.Si
Terms: ferrochromium decarburizing smelting
CT: CHROMIUM ORES,<in ferrochromium manufacture , melt treatment with mixture containing>/LIME,chemical, in ferrochromium manufacture , melt treatment with mixture containing>/nonbase/base/compounds

Quest Accession Number : 10235021
110(26)235021 CHEMABS report
Production of refined ferromanganese in a transferred-ARC plasma furnace
Schoukens, A. F. S.; Ford, M.
Counc. Miner. Technol. Randburg S. Afr. ZA
From: Gov. Rep. Announce. Index (U. S.) 1988, 88(22), Abstr. No. 856,101.
Document type: TECHNICAL REPORT; Report; (88) P 25 pp.; No MINTEK-M250D; Order No. PB88-233895,; In Eng; Avail.: NTIS; Coden: DBREP;
Sections: 154002
Registry No.: 12604-53-4 <production of refined, in transferred arc plasma furnace>
Mol. Formula: C.Fe.Mn.P.Si
Terms: plasma furnace refined ferromanganese production
CT: FURNACES,<plasma, production of refined ferromanganese in>/nonbase/base

Quest Accession Number : 10196947
110(22)196947 CHEMABS journal
Use of waste slag from romanganese manufacture in cupola melting of cast iron
Koteshov, N. P.; Masich-Stukalc, O. Yu.; Sotsenko, A. V.
USSR SU
Liteinoe Proizvod.; (88) P 24-5; No 12; In Russ; Coden: LIPRA; ISSN: 0024449;
Sections: 155002
Registry No.: 11097-15-7 preparation <manufacture of, ferromanganese replacement with slag in melting charge for>; 12604-53-4 <manufacture of, slag waste from, cast iron melting charge with>
Mol. Formula: W99; C.Fe.Mn.P.Si
Terms: manganese oxide slag cast iron / ferromanganese slag cast iron / roll cast iron melting slag
CT: CASTING PROCESS,<of cast iron, ferromanganese waste slag in melting charge for>/ROLLS,<cast iron for, melting of, ferromanganese slag waste in charge for>/SLAGS,<ferromanganese waste, cast iron from melting charge containing>/nonbase/base

Quest Accession Number : 10177067
110(20)177067 CHEMABS journal
Improvement of the manufacture of low-carbon ferrochromium
Shcherbin, A. N.; Ostrovskii, Ya. I.; Bushuev, G. F.; Mezyalaev, G. V.
Serov. Zavod Ferrosplavov USSR SU
Stal'; (89) P 47-9; No 1; In Russ; Coden: STALA; ISSN: [illegible];
Sections: 154002
Registry No.: 11114-46-8 <preparation of low carbon, decarbonated lime for>; 60226-79-1 [illegible]
Mol. Formula: C.Cr.Fe.N.Si; C.Cr.Fe.Si
Terms: ferrochromium smelting decarbonated lime
CT: LIME,chemical,<highly decarbonated, for low carbon ferrochromium smelting>/nonbase/base/compounds

Quest Accession Number : 10079781
110(10)079781 CHEMABS journal
Plasma in ferrochromium manufacture
Rozolimo, Paulina; Ancut, R.
ICEM Czech. CS
Metalurgia (Bucharest); (88) P 127-30; Vol 40; No 3; In Rom; Coden: MTURA; ISSN: 0461957;
Sections: 154000
Registry No.: 11114-46-8 <preparation of, Plasmachrome process for>
Mol. Formula: C.Cr.Fe.N.Si
Terms: review ferrochromium manufacture Plasmachrome process
CT: PLASMA,chemical and physical effects,<ferrochromium smelting in>/nonbase/base/compounds

Quest Accession Number : 09213919
109(24)213919 CHEMABS journal
Ferrochromium from domestic lateritic chromites
Nafziger, Ralph H.
Albany Res. Cent. Pyrometall. Sect. U. S. Bur. Mines' USA US OR
J. Met.; (88) P 34-7; Vol 40; No 9; In Eng; Coden: JOMTA; ISSN: 0022267;
Sections: 154002
Registry No.: 1308-31-2 <concentrate from lateritic cobalt nickel ore waste, ferrochromium smelting from>; 11114-46-8 <smelting of, from chromite concentrate from lateritic cobalt nickel ore waste>
Mol. Formula: Cr2FeO4; C.Cr.Fe.N.Si
Terms: ferrochromium smelting chromite ore waste / cobalt nickel ore waste ferrochromium
CT: COKE,metallurgical,<chromite concentrate smelting with, for ferrochromium preparation>/WASTE SOLIDS,<lateritic cobalt nickel ore, ferrochromium smelting from chromite concentrate from>/nonbase/base/c-ompounds

Quest Accession Number : 09194342
109(22)194342 CHEMABS journal
Modeling of step-wise reduction of iron-chromium-nickel ores
Petrov, L. V.; Kolesnikov, Yu. A.; Kotii, V. N.
USSR SU
From: Ref. Zh., Metall. 1988, Abstr. No. 5A103.
Sovers. Tekhnol. i Avtomatiz. Staleplavil'n. Protseasov; (87) P 67-71; No 6; In Russ; Coden: D3RAP;
Sections: 154002
Registry No.: 11097-15-7 preparation <pig, smelting of, from iron chromium nickel ore>; 11114-46-8 <smelting of, from iron chromium nickel ore>; 11133-76-9 <*>
Mol. Formula: W99; C.Cr.Fe.N.Si; Fe.Ni
Terms: iron chromium nickel ore smelting / pig iron smelting complex ore / ferrochromium smelting complex ore / ferronickel smelting complex ore
CT: nonbase/base/compounds

Quest Accession Number : 09173979
109(20)173979 CHEMABS journal
H.C. ferromanganese production on the high alumina practice using 100% Moanda ore
Ratzlaff, Richard G.
Elkem Met. Canada Inc. Beauharnois Can. CA PQ
Electr. Furn. Conf. Proc.; (87) P 169-73; Vol 44,; In Eng; Coden: EFCPA; ISSN: 0096012; Date: 86;
Sections: 154002
Registry No.: 12604-53-4 <smelting of high carbon, high alumina slag for>
Mol. Formula: C.Fe.Mn.P.Si
Terms: ferromanganese smelting high alumina slag
CT: nonbase/base

Quest Accession Number : 09173954
109(20)173954 CHEMABS report
The production of refined ferromanganese in a transferred-arc plasma furnace
Schoukens, Albert Francois Simon; Ford, Michael
Pyrometall. Div. MINTEK S. Afr. ZA
Document type: TECHNICAL REPORT; Rep. - MINTEK; (88) P 21 pp.; No M250D,; In Eng; Coden: RMNTD; ISSN: 0254181;
Sections: 154002
Registry No.: 117117-98-3 <production of, in transferred arc plasma furnace>
Mol. Formula: C.Fe.Mn.P.Si
Terms: ferromanganese smelting refining medium carbon / plasma furnace ferromanganese smelting refining
CT: FURNACES,electric,<transferred arc plasma, ferromanganese smelting and refining in>/nonbase/base

Quest Accession Number : 09153715
109(18)153715 CHEMABS journal
The effect of nickel additions on the decarburization of liquid high-carbon ferrochromium
Dresler, W.
Sch. Eng. Laurentian Univ. Sudbury Can. CA ON
Iron Steelmaker; (88) P 43-51; Vol 15; No 1; In Eng; Coden: IRSTD; ISSN: 0275868;
Sections: 155001
Registry No.: 7440-02-0 reactions <in oxygen decarburization of liquid high carbon ferrochromium ; 7782-44-7 reactions <decarburization with, of liquid high carbon ferrochromium nickel effect on>; 11114-46-8 <oxygen decarburization of high carbon liquid , nickel effect on>
Mol. Formula: Ni; O2; C.Cr.Fe.N.Si
Terms: decarburization liquid high carbon ferrochromium nickel decarburization liquid ferrochromium thermodynamic decarburization liquid ferrochromium / oxygen decarburization liquid ferrochromium simulation
CT: PROCESS SIMULATION,physicochemical,<of oxygen decarburization, of liquid high carbon ferrochromium /nonbase/base/compounds

Quest Accession Number : 09077144
109(10)077144 CHEMABS patent
Charge for production of ferrosilicochromium
Borak, Arnost
Czech. CS
Czech.; (880315) P 2 pp.; In Slo; Coden: CZXXA;
Pat. No.: 248129; Int. Class: C22C-035/00 A; Doc. Code: B1;
Appl.: CS 83/8969 831201;
Sections: 154002
Registry No.: 1309-48-4 preparation <chromium ore containing , smelting charge with, ferrosilicochromium from>; 1318-16-7 uses and miscellaneous <smelting charge containing , ferrosilicochromium from>; 7439-89-6 uses and miscellaneous <*>; 11114-46-8D <*>; 11133-78-1 <manufacture of, from magnesia containing ore, smelting charge for>; 115907-91-0 <manufacture of, smelting charge for, magnesia containing ore in>
Mol. Formula: MgO; Al2O3.xH2O; Fe; C.Cr.Fe.N.Si; C.Cr.Fe.Si; Cr.Fe.Si
Terms: ferrosilicochromium smelting charge
CT: COKE,<smelting charge containing , ferrosilicochromium from>/WOOD,chips,<smelting charge containing , ferrosilicochromium from>/nonbase/base/compounds

Quest Accession Number : 09041217
109(06)041217 CHEMABS journal
Experiences in the manufacture of ferrosilicochromium by a single-stage process
Newski, Wieslaw; Wyrobek, Alojzy
Huta Laziska Laziska Gorne Pol. PL
Hutnik; (87) P 273-5; Vol 54; No 10; In Pol; Coden: HUTNA; ISSN: 0018807;
Sections: 154002
Registry No.: 115250-72-1 <smelting of, from chromium ores in electric furnace>; 115250-73-2 <*>
Mol. Formula: W99
Terms: ferrosilicochromium smelting chromium ore

Quest Accession Number : 09009843
109(02)009843 CHEMABS journal
Effectiveness of the use of ferrochromium in the manufacture of corrosion-resistant steels by the VOD process
Szwej, Henryk; Kulhawik, Wladyslaw; Mista, Stanislaw
Huta Baildon Katowice Pol. PL
Hutnik; (87) P 288-90; Vol 54; No 10; In Pol; Coden: HUTNA; ISSN: 0018807;
Sections: 155001
Registry No.: 11109-50-5 <manufacture of, with vacuum oxygen decarburizing, ferrochromium effectiveness in>; 11114-46-8 <in stainless steel manufacture , with vacuum oxygen decarburizing, effectiveness of>; 12597-68-1 preparation <manufacture of, with vacuum oxygen decarburizing, ferrochromium effectiveness in>; 12611-78-8 <*>; 12611-86-8 <*>; 39345-19-2 <*>; 51654-92-3 <*>
Mol. Formula: C.Cr.Fe.Mn.Ni.Si; C.Cr.Fe.N.Si; W99; C.Cr.Fe.Mn.Ni.Si.Ti; Cr.Fe.Mn.Ni.Si; C.Cr.Fe.Mn.Si; C.Cr.Cu.Fe.Mn.Mo.-Ni.Si.Ti
Terms: stainless steel manufacture ferrochromium economics , vacuum oxygen decarburizing stainless steel
CT: nonbase/base/compounds

Quest Accession Number : 08215479
108(24)215479 CHEMABS journal
Analysis of slags, from ferrochromium production, by ICP atomic emission and x-ray fluorescence spectrometry
Kozak, E.; Hudnik, V.; Slekovec-Golob, M.; Vrecko, V.
"Boris Kidric" Inst. Chem. Ljubljana Yugoslavia YU
Vestn. Slov. Kem. Drus.; (87) P 351-60; Vol 34; No 3; In Eng; Coden: VSKDA; ISSN: 0560311;
Sections: 179006 / 155
Registry No.: 7429-90-5 analysis <determination of, in slags from ferrochromium production , by inductively coupled plasma at emission and x ray fluorescence spectrometry>; 7439-89-6 analysis <*>; 7439-95-4 analysis <*>; 7440-21-3 analysis <*>; 7440-47-3 analysis <*> ; 7440-70-2 analysis <*>; 11114-46-8 <preparation of, analysis of slags from, by inductively coupled plasma at emission and x ray fluorescence spectrometry>
Mol. Formula: Al; Fe; Mg; Si; Cr; Ca; C.Cr.Fe.N.Si
Terms: ferrochromium production slag analysis spectrometry / inductively coupled plasma slag analysis / emission spectrometry slag analysis / x ray fluorescence slag analysis
CT: SLAGS,<from ferrochromium production , analysis of, by inductively coupled plasma at emission and x ray fluorescence spectrometry>/SPECTROCHEMICAL ANALYSIS, at. emission,<of slags from ferrochromium production , with inductively coupled plasm /X-RAY ANALYSIS,fluorescence,<of slags from ferrochromium production nonbase/base/compounds

Quest Accession Number : 08171221
108(20)171221 CHEMABS journal
The production of ferrochrome for the stainless steel industry: past, present and future
Sciarone, M.
Consolidated Metall. Ind. Ltd. USA US
Iron Steelmaker; (87) P 28-9; Vol 14; No 4; In Eng; Coden: IRSTD ; ISSN: 0275868;
Sections: 154000 / 155
Registry No.: 11114-46-8 <production of, plasma torch and preredn processes for>; 12597-68-1 preparation <making of, ferrochromium production for>
Mol. Formula: C.Cr.Fe.N.Si; W99
Terms: ferrochrome preparation plasma preredn review
CT: nonbase/base/compounds

Quest Accession Number : 08154213
108(18)154213 CHEMABS patent
Manufacture of low-carbon ferrochromium granules
Shustorovich, V. M.; Patrikeev, V. S.; Glazunov, A. I.; Savelev, V. P.; Shushlebin, B. A.; Topil'skii, S. P.; Ryss, M. A.; Buldakov, V. N. ; Degtyannikov, S. N.
All-Union Scientific-Research Institute for Metallurgical Machine Construction
USSR SU
From: Otkrytiya, Izobret. 1987, (47), 120.
U.S.S.R. ; (871223) In Russ; Coden: URXXA;
Pat. No.: 1361194; Int. Class: C22C-033/04 A; B22D-023/04 B; Doc. Code: A1;
Appl.: SU 4008255 860117;
Sections: 154004
Registry No.: 11114-46-8 <manufacture of granular, quenching of thin casting and crushing in>
Mol. Formula: C.Cr.Fe.N.Si
Terms: ferrochromium melt ingot cooling / casting ingot ferrochromium cooling
CT: CAST METALS AND ALLOYS,<ferrochromium, quenching of, for granulation>/CASTING PROCESS,<of ferrochromium, in manufacturing granules by quenching and crushing>/nonbase/base/compounds

Quest Accession Number : 08149581
108(17)149581 CHEMABS patent
Manufacture of thermofertilizer in electric, induction, or other types of furnaces, using ferrochromium slag
Correia da Silveira, Rubens
Irmaos Ayres S. A. Construcoes Industria e Comercio
Brazil BR
Braz. Pedido PI; (871027) P 6 pp.; In Port; Coden: BPXXDX;
Pat. No.: 86 00985; Int. Class: [illegible] A; Doc. Code: A;
Appl.: BR 86/985 860307;
Sections: 119006
Terms: thermofertilizer ferrochromium slag
CT: FERTILIZERS,thermo-,<manufacture of, from ferrochromium slags>/SLAGS,ferrochromium,<thermofertilizers from>

Quest Accession Number : 08149579
108(17)149579 CHEMABS patent
Manufacture of thermofuertilizers in electric, induction, or other types of furnace, using ferromanganese slags
Correia da Silveira, Rubens
Irmaos Ayres S. A. Construcoes Industria e Comercio
Brazil BR
Braz. Pedido PI; (871027) P 6 pp.; In Port; Coden: BPXXD;
Pat. No.: 86 00984; Int. Class: C05F-013/00 A; Doc. Code: A;
Appl.: BR 86/984 860307;
Sections: 119006
Terms: ferromanganese slag thermofertilizer
CT: FERTILIZERS,thermo-,<manufacture of, from ferromanganese slags>/SLAGS,ferromanganese,<thermofertilizers from>

Quest Accession Number : 08098374
108(12)098374 CHEMABS journal
Improvement of the electrothermic technology for ferrosilicochromomanganese based on the phase equilibrium of manganous oxide-magnesium oxide-chromic oxide-aluminum oxide-silicon dioxide systems
Takenov, T. D.; Baisenov, S. O.; Gabdullin, T. G.; Zhakibekov, T. B.
USSR SU
Pr-vo Ferrosplavov, Novokuznetsk; (87) P 91-5; In Russ; Coden: D3RAP;
Sections: 154002
Registry No.: 1308-38-9 properties <systems, alumina magnesia manganous oxide silica , phase equilibrium in, electric smelting of ferrosilicochromomanganese in relation to>; 1309-48-4 properties <systems, alumina chromia manganous oxide silica , phase equilibrium in, electric smelting of ferrosilicochromomanganese in relation to>; 1344-28-1 properties <systems, chromia magnesia manganese oxide silica , phase equilibrium in, electric smelting of ferrosilicochromomanganese in relation to>; 1344-43-0 properties <systems, alumina chromia magnesia silica , phase equilibrium in, electric smelting of ferrosilicochromomanganese in relation to>; 7631-86-9 properties <systems, alumina chromia magnesia manganese oxide , phase equilibrium in, electric smelting of ferrosilicochromomanganese in relation to>; 113169-73-6 <electric smelting of, from mixture of chromium ore and manganese ore coal briquets, phase equilibrium of oxide system in relation to>
Mol. Formula: Cr2O3; MgO; Al2O3; MnO; O2Si; W99
Terms: ferrosilicochromomanganese electrothermic smelting charge composition / phase equilibrium oxide system ferrosilicochromomanganese
CT: CHROMIUM ORES,<electric smelting of ferrosilicochromomanganese from mixture of manganese ore coal briquets and, oxide system phase equilibrium in relation to>/[illegible], electric smelting of ferrosilicochromomanganese from mixture of chromium ore and manganese ore with, oxide system phase equilibrium in relation to>/MANGANESE ORES,<electric smelting of ferrosilicochromomanganese from mixture of chromium ore and briquets containing coal and, oxide system phase equilibrium in relation to>

Quest Accession Number : 08097396
108(12)097396 CHEMABS journal
Refinement of technological conditions for the production of ferrochromolignosulfonates
Dadyka, L. A.; Gevorgyan, V. N.
USSR SU
From: Ref. Zh., Geol. 1987, Abstr. No. 11L71.
Rastvory i Tekhnol. Trebovaniya k ikh Svoistvam, Krasnodar; (86) P 93-8; In Russ; Coden: D3RAP;
Sections: 151002
Registry No.: 8075-74-9 <drilling fluid additives>
Mol. Formula: W99
Terms: drilling fluid iron chromium liquosulfonate
CT: DRILLING FLUIDS AND MUDS,<containing chromium iron lignosulfonate>

Quest Accession Number : 08079179
108(10)079179 CHEMABS journal
Chromium yields of oxygen-treated high-carbon ferrochromium in the presence of nickel
Dresler, Werner
Laurentian Univ. Sudbury Can. CA ON
Proc. Steelmaking Conf.; (86) P 37-43; Vol 69; No Int. Iron Steel Congr., 5th, 1986, Bk. 1; In Eng; Coden: PSTCE;
Sections: 154002 / 155
Registry No.: 1308-38-9 reactions <in slag from decarburization of ferrochromium, alloy nickel content effet on>; 11114-46-8 <decarburization of, chromium yield in, nickel effect on>; 112387-91-4 <chromium yield of, from decarburization of high carbon ferrochromium> ; 112387-92-5 <*>; 112387-93-6 <*>; 112387-94-7 <*>; 112387-95-8 <chromium yield of, from decarburization of high carbon ferrochromium, nickel content with respect to>; 112387-96-9 <*>; 112387-97-0 <*>; 112387-98-1 <*>; 112417-58-0 <*>; 112771-99-0 <*>; 112772-00-6 <*>
Mol. Formula: Cr2O3; C.Cr.Fe.N.Si; C.Cr.Fe.Si; C.Cr.Fe.Ni.Si
Terms: ferrochromium decarburization nickel chromium yield
CT: SLAGS,<from ferrochromium decarburization, chromium oxide concentration in, alloy nickel content effect on>/nonbase/base/compounds

Quest Accession Number : 08059964
108(08)059964 CHEMABS journal
Predicting the change of the slag lining thickness in a high-temperature reactor (ladle) during the silicothermic production of ferrochromium
Buslakov, A. P.: Krupennikov, S. A.; Filimonov, Yu. p.; Bobl ova, O. S.; Vasil'ev, V. I.; D'yakonova, L. A.; Gnedina, I. A.; Naryzl nyi, V. D.
MISiS Moscow USSR SU
Stal'; (87) P 49-52; No 9; In Russ; Coden: STALA; ISSN: 0038920;
Sections: 154002 / 155
Registry No.: 11114-46-8 <preparation of, slag lining control in ladle in, model for>
Mol. Formula: C.Cr.Fe.N.Si
Terms: ferrochromium ladle slag lining model
CT: LADLES,<slag lining of, in ferrochromium preparation>/LININGS,<slag, of ladle in ferrochromium preparation>/PROCESS SIMULATION,physicochemical,<of slag lining formation in ladle in ferrochromium preparation>/SLAGS,<lining in ladle, in ferrochromium preparation>/nonbase/base/compounds

Quest Accession Number : 08042140
108(06)042140 CHEMABS journal
The production of ferrochrome for the stainless steel industry: past, present and future
Sciarone, Marcel
Consol. Metall. Ind. Ltd. USA US
Proc. Steelmaking Conf.; (86) P 3-5; Vol 69; No Int. Iron Steel Congr., 5th, 1986, Bk. 1; In Eng; Coden: PSTCE;
Sections: 156000
Registry No.: 12597-68-1 preparation <ferrochrome and chromium silicide for production of, preparation of>; 71991-61-2 <preparation of, for stainless steel production>; 112264-73-0 <*>
Mol. Formula: W99; C.Cr.Fe.Si; W99
Terms: review ferrochrome stainless steel production / silicochrome stainless steel production review / stainless steel ferrochrome silicochrome review
CT: base/nonbase

Quest Accession Number : 08024998
108(04)024998 CHEMABS patent
Ferrochromium manufacture
Bushuev, G. F.; Likhobaba, V. I.; Ostrovskii, Ya. I.; Mezyalaev, G. V.; Shcherbin, A. N.; Serditov, Yu. P.
USSR SU
U.S.S.R. ; (870823) In Russ; Coden: URXXA;
Pat. No.: 1331900; Int. Class: C22C-033/04 A; Doc. Code: A1;
Appl.: SU 4042116 860324;
Sections: 154002
Registry No.: 11114-46-8 <manufacture of, ore smelting with silicon in>
Mol. Formula: C.Cr.Fe.N.Si
Terms: ferrochromium smelting ore reduction silicon
CT: CHROMIUM ORES,<smelting feed containing , in ferrochromium manufacture>/LIME,chemical,<smelting feed containing , in ferrochromium manufacture>/nonbase/base/compounds

Quest Accession Number : 08024997
108(04)024997 CHEMABS patent
Charge for ferrosilicochromium
Zhuchkov, V. I.; Zav'yalov, A. L.; Lukin, S. V.; Ostrovskii, Ya. I.; Serditov, Yu. P.; Shatov, Yu. I.; Shcherbin, A. N.
Ural Institute of Metallurgy
USSR SU
From: Otkrytiya, Izobret. 1987, (31), 98.
U.S.S.R. ; (870823) In Russ; Coden: URXXA;
Pat. No.: 1331899; Int. Class: C22C-033/04 A; Doc. Code: A1;
Appl.: SU 3985441 851209;
Sections: 154002
Registry No.: 11114-46-8 <furnace charge containing , for manufacture of ferrosilicochromium>; 11133-78-1 <manufacture of, furnace charge for>; 13462-86-7 <smelting charge containing , for manufacture of ferrosilicochromium>
Mol. Formula: C.Cr.Fe.N.Si; C.Cr.Fe.Si; H2O4S.Ba
Terms: ferrosilicochromium smelting furnace charge / baryte smelting ferrosilicochromium
CT: QUARTZITE,<smelting charge containing , for manufacture of ferrosilicochromium>/nonbase/base/compounds

Quest Accession Number : 07101857
107(12)101857 CHEMABS journal
Morbidity with temporary disability of workers of the shops for separation of slags of the low-carbon ferrochromium production
Konstantinova, L. T.; Blokhin, V. A.; Ryabova, G. A.
USSR SU
From: Ref. Zh., Khim. 1987, Abstr. No. 4I537.
Prof. Bolezni Pylev. Etiol., M.; (86) P 32-6; In Russ; Coden: D3RAP;
Sections: 159005 / 104 / 155 / 156
Registry No.: 11114-46-8 <slags, separation of, occupational morbidity in, hygiene in relation to>
Mol. Formula: C.Cr.Fe.N.Si
Terms: occupational morbidity ferrochromium slag separation / health ferrochromium production slag separation / industrial hygiene morbidity ferrochromium manufacture
CT: HEALTH HAZARD,occupational,<in ferrochromium slag separation , hygiene in relation to>/HYGIENE,industrial,<in ferrochromium manufacturing slag separation , morbidity in relation to>/SLAGS,ferrochromium,<separation of, occupational morbidity in, hygiene in relation to>/nonbase/base/compounds

Quest Accession Number : 07045465
107(06)045465 CHEMABS conference
Characteristics of occupational dust pathology in workers during electric furnace production of ferrochromium and silicochromium under modern conditions
Buravleva, N. N.; Ganyushkina, S. M.; Zaslavskii, A. K.; Podkin, Yu. S.; Tarasov, A. S.
USSR SU
Document type: CONFERENCE; Probl. Gig. Tr., Profpatol. Toksikol. Gornodobyvayushchei Metall. Prom-sti.; (85) P 44-52; In Russ; Avail.: Domnin, S. G; Coden: 55VJA; Publisher: Mosk. Nauchno-Issled. Inst. Gig, Moscow, USSR;
Sections: 159005 / 155 / 156
Registry No.: 7631-86-9 biological studies <occupational exposure to dust containing , lung and skin disorders from, in foundries>; 11114-46-8 <*>; 11133-78-1 <*>
Mol. Formula: O2Si; C.Cr.Fe.N.Si; C.Cr.Fe.Si
Terms: ferrochromium silicochromium manufacture lung disease / dermatosis silicosis metallurgical worker / asthma occupational metallurgy / emphysema occupational metallurgy / bronchitis occupational metallurgy
CT: AIR POLLUTION,<by ferrochromium and silica and silicochromium containing dust, occupational exposure to, lung and skin disorders from, in foundries>/ASTHMA,<from occupational exposure to dust containing ferrochromium and silica and silicochromium in foundries>/BRONCHI,diseases, bronchitis,<from occupational exposure to dust containing ferrochromium and silica and silicochromium in foundries>/DUST,<ferrochromium and silica and silicochromium containing , occupational exposure to, skin and lung disorders from, in foundries>/EMPHYSEMA,<from occupational exposure to dust containing ferrochromium and silica and silicochromium in foundries>/FOUNDRIES,<dust in, occupational exposure to, lung and skin disorders from>/HYGIENE,industrial,<in foundries, lung and skin disorders from exposure to dust in relation to>/LUNG,sclerosis,disease or disorder,<from occupational exposure to dust containing ferrochromium and silica and silicochromium, in foundries>/SILICOSIS,<from occupational exposure to dust containing ferrochromium and silica and silicochromium in foundries>/SKIN,disease or disorder,<allergic, from occupational exposure to dust containing ferrochromium and silicochromium and silica, in foundries>/nonbase/base/compounds

Quest Accession Number : 07043846
107(06)043846 CHEMABS journal
Formation of structure of iron-chromium coatings obtained by ion spraying
Kostrzhitskii, A. I.; Gusareva, O. F.
Odessa USSR SU
Izv. Akad. Nauk SSSR, Met.; (87) P 169-72; No 1; In Russ; Coden: IZNMA; ISSN: 0568530;
Sections: 155006
Registry No.: 12666-48-7 <coating of, by spraying of ferrochromium ions, structure of deposited layer in relation to>; 62044-97-7 <ion spraying with, coating structure by>
Mol. Formula: Co.Fe.Mn.Ni.Si; C.Cr.Fe.Si
Terms: structure ferrochromium coating ion spraying
CT: COATING MATERIALS,<ferrochromium, ion spraying of, on iron nickel cobalt alloy substrate, structure of deposited layer in relation to>/COATING PROCESS,spray,<ion, of ferrochromium on iron nickel cobalt alloy substrate, structure of deposited layer in relation to>/nonbase/base

Quest Accession Number : 07043629
107(06)043629 CHEMABS journal
Plasmachrome process for ferrochrome production - thermochemical modelling and application to process data
Srinivasan, Nadipur Sampath; Santen, Sven; Staffansson, Lars-Ingvar
Dep. Theor. Metall. R. Inst. Technol. Stockholm Swed. SE
Steel Res.; (87) P 151-6; Vol 58; No 4; In Eng; Coden: STRSE;
Sections: 154002
Registry No.: 109303-27-7 <plasma smelting of, thermochemical model for>
Mol. Formula: C.Cr.Fe.Si
Terms: ferrochromium plasma smelting thermochemical model
CT: PROCESS SIMULATION,physicochemical,<of ferrochromium plasma smelting>/nonbase/base

Quest Accession Number : 06217900
106(26)217900 CHEMABS journal
Interaction between structural components of composites based on titanium carbide
Panasyuk, A. D.; Umanskii, A. P.
Inst. Probl. Materialoved. Kiev USSR SU
Poroshk. Metall. (Kiev); (87) P 79-82; No 2; In Russ; Coden: PMANA; ISSN: 0032479;
Sections: 156004 / 166
Registry No.: 12070-08-5 <contact angle and adhesive work and surface tension of ferroalloys on>; 12666-85-2 <contact angle and adhesive work and surface tension of, on titanium carbide>; 51397-37-6 <*>; 108426-07-9 <hot pressing of, densification and activation energy in>; 108426-08-0 <*>; 108426-09-1 <contact angle and adhesive work and surface tension of, on titanium carbide>; 108426-10-4 <*>
Mol. Formula: CTi; Fe.Ni; Cr.Fe; CTi.Al.Fe.Ni; CTi.Al.Cr.Fe; Al.Cr.Fe; Al.Fe.Ni
Terms: titanium carbide ferroalloy adhesive work / surface tension titanium carbide ferroalloy / contact angle titanium carbide ferroalloy / hot pressing titanium carbide ferroalloy / aluminum ferroalloy titanium carbide wetting / ferronickel aluminum titanium carbide wetting / ferrochromium aluminum titanium carbide wetting
CT: CONTACT ANGLE,<of ferroalloys, on titanium carbide>/ENERGY,adhesive,<of ferroalloys, on titanium carbide>/SURFACE TENSION,<of ferroalloys, on titanium carbide>/base/nonbase

Quest Accession Number : 06199580
106(24)199580 CHEMABS journal
A review of the behavior of impurities in high carbon ferrochromium production
Pickles, C. A.; Tsubokura, J.; McLean, A.
Dep. Metall. Eng. Queen's Univ. Kingston Can. CA ON
Trans. Iron Steel Soc.; (87) P 45-57; Vol 8,; In Eng; Coden: TISSE;
Sections: 154000
Registry No.: 11114-46-8 <smelting of high carbon, impurities in>
Mol. Formula: C.Cr.Fe.N.Si
Terms: review ferrochromium smelting impurity / carbon ferrochromium smelting review / silicon ferrochromium smelting review / sulfur ferrochromium smelting review / phosphorus ferrochromium smelting review / nitrogen ferrochromium smelting review
CT: nonbase/base/compounds

Quest Accession Number : 06180280
106(22)180280 CHEMABS journal
Formation of sublimates in smelting two-stage ferrosilicochromium in a closed furnace
Kadarmetov, Kh. N.; Vertii, I. G.; Podmeshal'skii, V. G.; Yachov, V. F.
Chelyabinsk USSR SU
Izv. Akad. Nauk SSSR, Met.; (87) P 8-11; No 1; In Russ; Coden: IZNMA; ISSN: 0568530;
Sections: 154002
Registry No.: 10097-28-6 <formation of, in smelting of ferrosilicochromium in closed furnace>; 37322-16-0 <smelting of, in closed furnace, sublimate formation in>; 50645-52-8 <*>; 57208-87-4 <smelting of, 2 stage, in closed furnace, sublimate formation in>; 80620-43-5 <*>
Mol. Formula: OSi; C.Al.Fe.Mn.Si; W99; C.Cr.Fe.Si; W99
Terms: carbide silicon ferrochromium smelting / ferrosilicon smelting closed furnace sublimate / ferrosilicochromium smelting closed furnace sublimate / silicon monoxide ferrochromium smelting
CT: nonbase/base

Quest Accession Number : 06123537
106(16)123537 CHEMABS patent
Utilization of flue dust from ferromanganese manufacture
Boiangiu, Cristian; Ancut, Roman; Untea, Gheorghe; Bucuresteanu, Ioan; Rozolimo, Paulina; Vladescu, Mihai; Landes, Victor Spiridon; Raileanu, Mihaela
Combinatul Metalurgic, Tulcea
Rom. RO
Rom.; (860530) P 4 pp.; In Rom; Coden: RUXXA;
Pat. No.: 89474; Int. Class: C22B-001/245 A; C22C-035/00 B; Doc. Code: 91;
Appl.: RO 116201 841107;
Sections: 154002
Registry No.: 9004-53-9 <briquetting with, of flue dust for silicomanganese manufacture>; 12604-53-4 <manufacture of, flue dust from, briquetting with flux of, for silicomanganese manufacture>; 12743-28-1 <manufacture of, by briquetting of manganese rich flue dust with lime and dextrin and charcoal and water for>
Mol. Formula: W99; C.Fe.Mn.P.Si
Terms: flue dust ferromanganese flux / silicomanganese smelting briquet flux
CT: CHARCOAL,<briquetting with, of flue dust for silicomanganese manufacture>/FLUE DUST,<from ferromanganese manufacture, briquetting of, for smelting of silicomanganese>/LIME,chemical, briquetting with, of flue dust for silicomanganese manufacture>/ORE BRIQUETS,<from ferromanganese dust, for smelting of silicomanganese>/nonbase/base

Quest Accession Number : 06070837
106(10)070837 CHEMABS patent
Manufacture of low-phosphorus ferrochromium
Bushuev, G. F.; Ostrovskii, Ya. I.; Brodskii, A. Ya.; Serditov, Yu. P.; Likhobaba, V. I.; Mezyakaev, G. V.; Shcherbin, A. N.
USSR SU
From: Otkrytiya, Izobret. 1986, (35), 105.
U.S.S.R. ; (860923) In Russ; Coden: URXXA;
Pat. No.: 1258842; Int. Class: C21C-007/00 A; Doc. Code: A1;
Appl.: SU 3878231 850327;
Sections: 154002
Registry No.: 11114-46-8 <manufacture of low phosphorus, ferrosilicochromium addition to melt in ladle for>; 11133-78-1 <molten, ladle addition of, for ferrochromium manufacture>
Mol. Formula: C.Cr.Fe.N.Si; C.Cr.Fe.Si
Terms: ferrochromium manufacture ladle melt mixing / ferrosilicochromium melt ladle ferrochromium
CT: nonbase/base/compounds

Quest Accession Number : 06070728
106(10)070728 CHEMABS journal
New economical technology for the manufacture of FMn85U0.2 ferromanganese
Gasik, M. I.; Ishutin, V. I.; Bublikov, A. V.; Sarankin, V. A.; Shaposhnik, L. I.; Verbitskii, K. P.
Dnepropetr. Metall. Inst. Dnepropetrovsk USSR SU
Stal'; (86) P 40-4; No 7; In Russ; Coden: STALA; ISSN: 0038920;
Sections: 154002
Registry No.: 7440-21-3 reactions <reduction by, of manganese oxides in ores, ferromanganese preparation by>; 12597-69-2 preparation <manganese high, preparation of, ferromanganese for>; 12742-94-8 <preparation of, ferromanganese for>; 106642-76-6 <preparation of, silicothermic, manganese recovery in>
Mol. Formula: Si; W99; C.Cr.Fe.Mn.Ni.Si.Ti; C.Al.Ca.Fe.Mg.Mn.P.Si
Terms: ferromanganese silicothermic reduction steel alloying
CT: nonbase/base

Quest Accession Number : 06053756
106(08)053756 CHEMABS journal
Manufacture of nitrided ferrochromium
Vladescu, M.; Raileanu, Mihaela; Landes, V. S.; Boiangiu, C.; Ancut, R.
ICEM Rom. RO
Cerc. [illegible] Metal.; (85) P 73-80; [illegible]; In Rom; Coden CERMB; ISSN: 0524814;
Sections: 154003
Registry No.: 11114-46-8 <nitridation of>; [illegible]
Mol. Formula: C.Cr.Fe.N.Si; [illegible]
Terms: ferrochromium nitridation
CT: NITRIDATION, of ferrochromium /nonbase/base/compounds

Quest Accession Number : 06036369
106(06)036369 CHEMABS journal
A review of the behavior of impurities in high carbon ferrochromium production
Pickles, C. A.; Tsubokura, J.; McLean, A.
Dep. Metall. Eng. Queen's Univ. Kingston Can. CA ON
Iron Steelmaker; (86) P 37-49; Vol 13; No 12; In Eng; Coden: IRSTD; ISSN: 0275868;
Sections: 154000
Registry No.: 11114-46-8 <smelting of high carbon, in submerged arc furnace, impurity removal in>
Mol. Formula: C.Cr.Fe.N.Si
Terms: review smelting carbon high ferrochromium
CT: nonbase/base/compounds

Quest Accession Number : 05212667
105(24)212667 CHEMABS patent
Electrode coating composition
Stepanov, B. V.; Yakovlev, V. V.; Morozova, R. V.; Rylova, G. Ya.; Sevan'kaev, A. T.
"Uralmash" Industrial Enterprises
USSR SU
From: Otkrytiya, Izobret. 1986, (29), 45.
U.S.S.R. ; (860807) In Russ; Coden: URXXA;
Pat. No.: 1248749; Int. Class: B23K-035/365 A; Doc. Code: A1;
Appl.: SU 3839531 850107;
Sections: 155009
Registry No.: 3333-67-3 <flux mixtures containing , on welding electrodes for steel>; 7440-02-0 uses and miscellaneous <*>; 8049-17-0 <*>; 11114-46-8 <*>; 11121-95-2 <*>; 12604-53-4 <*>; 12604-56-7 <*>; 14808-60-7 uses and miscellaneous <*>; 15096-52-3 <*>
Mol. Formula: CH2O3.Ni; Ni; W99; C.Cr.Fe.N.Si; C.Cu.Fe.Mo.P.S.Si; C.Fe.Mn.P.Si; W99; O2Si; AlF6.3Na
Terms: welding steel electrode coating flux / nickel carbonate flux welding electrode / cryolite flux welding electrode / ferrochromium flux welding electrode
CT: FELDSPAR-GROUP MINERALS,<flux mixtures containing , on welding electrodes for steel>/MARBLE,<flux mixtures containing , on welding electrodes for steel>/WELDING,electrodes,<for steel, flux coating on>/compounds/nonbase/base

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[21-01-1992 Pg:00

Quest Accession Number : 05156542
105(18)156542 CHEMABS journal
Mathematical model of coke ratio for ferromanganese production in blast furnace
Yuan, Meixing
Xiangtan Manganese Mine Peop. Rep. China CN
Gangtie; (86) P 38-40; Vol 21; No 5; In Ch; Coden: KATIA; ISSN: 0449749;
Sections: 154002
Registry No.: 12604-53-4 <manufacture of, in blast furnace, coke ratio in, model for>
Mol. Formula: C.Fe.Mn.P.Si
Terms: ferromanganese manufacture blast furnace model
CT: FURNACES,blast,<ferromanganese manufacture in, coke ratio in, model for>/PROCESS SIMULATION,physicochemical,<of manufacture of ferromanganese in blast furnace, coke ratio in relation to>/nonbase/base

Quest Accession Number : 05063125
105(08)063125 CHEMABS journal
Production of sodium monochromate from ferrochromium by the wasteless method
Kashirskaya, I. Ya.; Mazaletskii, G. D.; Bormontova, S. V.; Sorokina, V. P.
USSR SU
From: Ref. Zh., Khim. 1986, Abstr. No. 9L45.
Tr. Ural. N.-i. Khim. In-ta; (84) P 49-54; No 57; In Russ; Coden: D3RAP;
Sections: 149005
Registry No.: 7775-11-3 <recovery of, from ferrochromium by oxidizing roasting>; 11114-46-8 <oxidizing roasting of, sodium chromate recovery by>
Mol. Formula: CrH2O4.2Na; C.Cr.Fe.N.Si
Terms: sodium chromate recovery ferrochromium roasting
CT: nonbase/base/compounds

Quest Accession Number : 05009900
105(02)009900 CHEMABS journal
Use of high-carbon ferrochromium in the production of chromium cast iron
Teikh, V. A.; Dzyuba, G. S.
USSR SU
Liteinoe Proizvod.; (86) P 4-5; No 1; In Russ; Coden LIPRA; ISSN: 0024449;
Sections: 155002
Registry No.: 51204-29-6 <alloying with, in preparation of high chromium wear resistant cast iron for shot blasting machine parts>; 102866-58-0 <preparation of wear resistant, for shot blasting machine parts>
Mol. Formula: C.Cr.Fe.Si; C.Cr.Fe.Mn.[illegible].Si
Terms: cast iron ferrochromium assimilation alloying / wear resistant chromium cast iron / shot blasting machine cast iron
CT: MACHINERY,<shot blasting, high chromium wear resistant cast iron for parts of>/nonbase/base

Quest Accession Number : 05009743
105(02)009743 CHEMABS journal
Technical and economic aspects of the production of ferromanganese in a blast furnace
Benesch, Ryszard; Kopec, Roman; Knihnicki, Roman; Ledzki, Andrzej; Bromer, Jerzy; Swieca, Jan
Akad. Gorn. Hutn. Krakow Pol. PL
Hutnik; (85) P 355-6; Vol 52; No 11-12; In Pol; Coden: HUTNA; ISSN: 0018807;
Sections: 154002
Registry No.: 12604-53-4 <smelting of, in blast furnace, economics of>
Mol. Formula: C.Fe.Mn.P.Si
Terms: ferromanganese smelting blast furnace economics
CT: FURNACES,blast,<ferromanganese smelting in, economics of>/nonbase/base

Quest Accession Number : 04210534
104(24)210534 CHEMABS conference
The production of ferrochromium in an rf plasma tailflame
Mehmetoglu, M. T.; Munz, R. J.; Gauvin, W. H.
Dep. Chem. Eng. Hacettepe Univ. Ankara Turk. TR
Document type: CONFERENCE; Symp. Proc. - Int. Symp. Plasma Chem., 7th; (85) P 1180-5; Vol 4,; In Eng; Avail.: Timmermans, C. J; Coden: 55BAA; Publisher: Eindhoven Univ. Technol., Eindhoven, Neth;
Sections: 154002
Registry No.: 7782-42-5 reactions <reduction by, of chromium ore, in plasma furnace>; 11114-46-8 <preparation of, from chromium ore, by reduction in plasma furnace>
Mol. Formula: C; C.Cr.Fe.N.Si
Terms: ferrochromium ore reduction plasma furnace
CT: CHROMIUM ORES,<reduction of, in plasma furnace, for ferrochromium preparation>/FURNACES,electric, plasma,<chromium ore reduction in, for ferrochromium preparation>/PLASMA,chemical and physical effects,<furnace, chromium ore reduction in, for ferrochromium preparation>/nonbase/base/compounds

Quest Accession Number : 04190270
104(22)190270 CHEMABS journal
Refining roasting of mixtures of nickel oxide and carbon ferrochromium
Istomin, A. S.; Ryzhonkov, D. I.; Kolchanov, V. A.
Mosk. Inst. Stali Splavov Moscow USSR SU
Izv. Vyssh. Uchebn. Zaved., Chern. Metall.; (86) P 9-12; [illegible] 3; In Russ; Coden: IVUMA; ISSN: 0368079;
Sections: 154002
Registry No.: 1313-99-1 [illegible] in decarburization of ferrochromium>; 7440-44-0 uses and miscellaneous <removal of, from ferrochromium, by oxidation with NiO>; [illegible] <decarburization of, by nickel oxide>; [illegible] <in decarburization of ferrochromium>
Mol. Formula: NiO; C; C.Cr.Fe.N.Si; [illegible]
Terms: ferrochromium decarburization nickel oxide
CT: nonbase/base/compounds

Quest Accession Number : 04153210
104(18)153210 CHEMABS patent
Refining of ferrosilicochromium
Hruda, Blahoslav
Czech. CS
Czech.; (850601) P 2 pp.; In Czech; Coden: CZXXA;
Pat. No.: 218742; Int. Class: C22C-038/02; Doc. Code: B;
Appl.: CS 79/8570 791210;
Sections: 154003
Registry No.: 1305-78-8 preparation <slag containing , ferrosilicochromium purification with>; 1344-28-1 preparation <*>; 11133-78-1 <manufacture of, alumina lime slag in, melt purification by>; 101406-07-9 <*>; 101406-08-0 <*>
Mol. Formula: CaO; Al2O3; C.Cr.Fe.Si; Cr.Fe.Si
Terms: ferrosilicochromium refining oxide slag
CT: SLAGS,<alumina lime, ferrosilicochromium purification with>/nonbase/base

Quest Accession Number : 04133601
104(16)133601 CHEMABS journal
Replacement of medium-carbon ferrochromium FKh100 by ferrosilicochromium FSKh33 in melting of steels 10KhSND and 15KhSND
Ryskina, S. G.; Egorov, A. L.; Arzamastsev, E. I.; Geints, G. E.; Zaslavskii, G. Z.; Luk'yanenko, A. A.
USSR SU
From: Ref. Zh., Metall. 1985, Abstr. No. 9V249.
Cher. Metallurgiya; (85) P 34-6; No 9; In Russ; Coden: D3EAP;
Sections: 155001
Registry No.: 12742-27-7 <melting of, ferrosilicochromium for>; 12742-28-8 <*>; 71833-04-0 <chromium steel melting with, deoxidation rate increase by>
Mol. Formula: C.Cr.Cu.Fe.Mn.Ni.Si; W99
Terms: chromium steel melting ferrosilicochromium
CT: base/nonbase

Quest Accession Number : 04133600
104(16)133600 CHEMABS journal
Optimization of electric smelting of ferrosilicochromium
Vunder, A. Yu.; Ostrovskii, Ya. I.; Shatov, Yu. I.; Vaisbrod, A. Ya.; Shcherbin, A. N.
USSR SU
From: Ref. Zh., Metall. 1985, Abstr. No. 9V195.
Cher. Metallurgiya; (85) P 46-8; No 9; In Russ; Coden: D3EAP;
Sections: 155001
Registry No.: 80620-43-5 <electrosmelting of, optimization o
Mol. Formula: W99
Terms: ferrosilicochromium electrosmelting optimization
CT: PROCESS OPTIMIZATION,<of ferrosilicochromium electrosmelting /base

Quest Accession Number : 04113591
104(14)113591 CHEMABS patent
Increasing the total utilization of chromium in the production of ferrochromium alloys
Hruda, Blahoslav
Czech. CS
Czech.; (850601) P 2 pp.; In Czech; Coden: CZXXA;
Pat. No.: 218743; Int. Class: C22C-038/18; Doc. Code: B;
Appl.: CS 79/8571 791210;
Sections: 154002
Registry No.: 7440-47-3 preparation <recovery of, from slags, treatment with ferrosilicochromium for>; 11114-46-8 <manufacture of, slags in, chromium recovery from>; 11133-78-1 <slag treatment with, chromium recovery by>; 100942-13-0 <*>; 100942-14-1 <*>
Mol. Formula: Cr; C.Cr.Fe.N.Si; C.Cr.Fe.Si; Cr.Fe.Si
Terms: ferrochromium slag chromium recovery / ferrosilicochromium mixing slag recovery
CT: SLAGS,<chromium recovery from, melt treatment with ferrosilicochromium for>/nonbase/base/compounds

Quest Accession Number : 04037504
104(06)037504 CHEMABS patent
Ferromanganese production by metallothermic reactions in the ladle
Demange, Michel; Septier, Louis
Societe Francaise d'Electrometallurgie (SOFREM)
Fr. FR
Eur. Pat. Appl.; (850828) P 14 pp.; In Fr; Coden: EPXXD;
Pat. No.: 153260; Int. Class: C22C-033/00 A; Doc. Code: A2;
Appl.: EP 85/420024 850212;
Priority Appl.: FR 84/2903 840214;
Des. Countries : AT; BE; CH; DE; GB; IT; LI; LU; NL; SE;
Sections: 154002
Registry No.: 12604-53-4 <manufacture of, ladle refining with blowing in, ferrosilicomanganese feed for>; 53200-80-9 <ladle refining of, silicon removal in, blowing for>; 99653-69-7 <manufacture of, ladle refining with blowing in, ferrosilicomanganese feed for>; 99653-70-0 <ladle refining of, silicon removal in, blowing control for>
Mol. Formula: C.Fe.Mn.P.Si; W99; C.Fe.Mn.Si; Fe.Mn.Si
Terms: ferromanganese manufacture ladle blowing / ferrosilicomanganese blowing ladle / manganese ore reduction ladle
CT: nonbase/base

Quest Accession Number : 03218803
103(26)218803 CHEMABS journal
Study of the means of energy conservation in the production of low-carbon ferrochromium by mathematical modeling
Bobkova, O. S.; Krupennikov, S. A.; Toptygin, A. M.; Filimonov, Yu. P.
TsNIIchermet Moscow USSR SU
Stal'; (85) P 40-2; No 9; In Russ; Coden: STALA; ISSN: 0038920;
Sections: 154002
Registry No.: 11114-46-8 <preparation of, mathematical model for optimization in>; 11133-78-1 <for ferrochromium preparation , mathematical model for addition of>
Mol. Formula: C.Cr.Fe.N.Si; C.Cr.Fe.Si
Terms: ferrochromium optimization model heat balance / ladle ferrochromium preparation optimization model
CT: COMPUTER APPLICATION,<for heat balance in ferrochromium preparation>/HEAT BALANCE,<computer simulation, for ferrochromium preparation optimization>/LADLES,<ferrochromium preparation in, mathematical model for optimization of>/PROCESS OPTIMIZATION,<of ferrochromium preparation , model for>/PROCESS SIMULATION,physicochemical,<in ferrochromium preparation>/nonbase/base/compounds

Quest Accession Number : 03164134
103(20)164134 CHEMABS journal
Production of ferrochromium from low-grade ores
Relander, John; Honkaniemi, Matti
Eng. Div. Outokumpu Oy Espoo Finland FI SF-02201
Int. J. Miner. Process.; (85) P 83-8; Vol 15; No 1-2; In Eng; Coden: IJMPB; ISSN: 0301751;
Sections: 154002
Registry No.: 1308-31-2 <ferrochromium production from low grade ores containing>; 11114-46-8 <recovery of, from chromite low grade ores>
Mol. Formula: Cr2FeO4; C.Cr.Fe.N.Si
Terms: ferrochromium production chromite concentrate
CT: nonbase/base/compounds

Quest Accession Number : 03164105
103(20)164105 CHEMABS journal
Hungarian electrothermic pilot-plant production of carbon-containing ferromanganese from sintered manganese ore from Urkut
Csutor, Tivadar; Kovacs, Janos; Solymar, Andras
Vaskohaszattani Tansz. NME Hung. HU
Banyasz. Kohasz. Lapok, Kohasz.; [illegible] P [illegible] 10; Vol 118; No 1; In Hung; Coden: BKLKB; ISSN: 000[illegible];
Sections: 154002
Registry No.: 7439-96-5 preparation [illegible] of, from manganese ore sinter, by reduction in electric furn[illegible] with coke; 12601[illegible] <*>; 98709-45-6 <*>
Mol. Formula: Mn; C.Fe.Mn.P.Si
Terms: manganese ore reduction electric furnace / ferromanganese recovery sinter reduction coke
CT: FURNACES,electric,<reduction in, of manganese ore sinters, for ferromanganese preparation>/MANGANESE ORES, sinter reduction of, in electric furnace, for ferromanganese preparation /nonbase/base

Quest Accession Number : 03090835
103(12)090835 CHEMABS journal
Preparation of lime for the manufacture of low-carbon ferrochromium
D'yakonova, L. A.; Vasil'ev, V. I.
Chelyab. Elektrometall. Komb. Chelyabinsk USSR SU
Stal'; (85) P 41-3; No 6; In Russ; Coden: STALA; ISSN: 0038920;
Sections: 154002 / 151
Registry No.: 11114-46-8 <manufacture of low carbon, lime for, calcination of>
Mol. Formula: C.Cr.Fe.N.Si
Terms: ferrochromium smelting lime charge / kiln limestone calcination burner / chromium ore limestone calcination burner
CT: CHROMIUM ORES,<limestone and powdered , lime manufacture from, heating in kiln for>/FLUE GASES,<in ferrochromium smelting, combustion of, natural gas mixing for heating from>/KILNS,rotary,<lime manufacture in, for ferrochromium smelting>/LIME,chemical,<in ferrochromium smelting, calcination of, rotary kiln firing for>/nonbase/base/compounds

Quest Accession Number : 03040725
103(06)040725 CHEMABS journal
Nitrogen solubility in molten iron, iron-chromium, and iron-chromium-nickel alloys
Banerjee, U. K.; Ballal, N. B.; Rao, P. Krishna
R and D Cent. Iron Steel SAIL Ranchi India IN 834002
Steel India; (84) P 66-72; Vol 7; No 2; In Eng; Coden: STINE;
Sections: 155013
Registry No.: 7439-89-6 properties <molten, nitrogen solubility in, levitation melting test for>; 7727-37-9 properties <solubility of, in molten iron and ferroalloys and stainless steel>; 11114-46-8 <molten, nitrogen solubility in, levitation melting test for>; 97244-64-9 <*>; 97244-65-0 <*>; 97244-66-1 <*>; 97265-30-0 <*>
Mol. Formula: Fe; N2; C.Cr.Fe.N.Si; C.Cr.Fe.Si; C.Co.Cr.Fe.Ni.Si; C.Cr.Fe.Mn.Ni.Si
Terms: nitrogen solubility stainless steel melt / iron melt nitrogen solubility / ferrochromium melt nitrogen solubility / ferronickel melt nitrogen solubility
CT: nonbase/base/compounds

Quest Accession Number : 03014754
103(02)014754 CHEMABS journal
Thermodynamic analysis of interaction between components of a powder mixture in eutectic coating formation
Golubets, V. M.; Pashechko, M. I.; Makarenko, O. N.
Fiz.-Mekh. Inst. Lvov USSR SU
Fiz.-Khim. Mekh. Mater.; (85) P 39-42; Vol 21; No 1; In Russ; Coden: FKMMA; ISSN: 0430625;
Sections: 175002 / 155 / 156 / 167 / 169
Registry No.: 7439-89-6 reactions <reactions of, in eutectic coating, thermodynamic of>; 7440-02-0 reactions <*>; 7440-21-3 reactions <*>; 7440-42-8 reactions <*>; 7440-44-0 reactions <*>; 7440-47-3 reactions <*>; 8049-17-0 <*>; 11114-46-8 <*>
Mol. Formula: Fe; Ni; Si; B; C; Cr; W99; C.Cr.Fe.N.Si
Terms: eutectic coating formation reaction probability thermodynamic / carbon metal reaction probability thermodynamic / silicon metal reaction probability thermodynamic / boron carbon reaction probability thermodynamic / nickel carbide oxide probability reaction / chromium carbide oxide probability reaction / ferrochromium carbide oxide probability reaction / ferrosilicon carbide oxide probability reaction / melt reaction probability thermodynamic eutectics
CT: BORIDES,<reactions of, in eutectic coating, thermodynamic of>/CARBIDES,<reactions of, in eutectic coating, thermodynamic of>/COATING PROCESS,<probability of reaction in eutectic mixture in relation to, thermodynamic of>/FREE ENERGY,<of reaction, of powdered mixture in eutectic formation, coating in relation to>/OXIDES,reactions,<reactions of, in eutectic coating, thermodynamic of>/PROBABILITY,<of reaction of powdered mixture in eutectic coating formation, thermodynamic in>/SALTS,reactions,<reactions of, in eutectic coating, thermodynamic of>/nonbase/base/compounds

Quest Accession Number : 02223890
102(26)223890 CHEMABS journal
Ferrochromium master alloy manufacture in a magnetohydrodynamic unit
Biletskii, A. K.; Dubodelov, V. I.; Dolzhikov, A. A.; Verkhovlyuk, A. M.
Inst. Probl. Lit'ya Kiev USSR SU
Izv. Vyssh. Uchebn. Zaved., Chern. Metall.; (85) P 8-11; No 3; In Russ; Coden: IVUMA; ISSN: 0368079;
Sections: 154002
Registry No.: 96571-81-2 <preparation of, by magnetohydrodynamic melting>
Mol. Formula: C.Cr.Fe
Terms: ferrochromium magnetohydrodynamic melting optimization
CT: MAGNETOHYDRODYNAMICS,<melting in, of ferrochromium master alloy>/nonbase/base

Quest Accession Number : 02135539
102(16)135539 CHEMABS journal
Production of low-carbon ferrochromium
Kulinski, Zdzislaw; Gladala, Krzysztof; Rudawski, Marian
Pol. PL
Wiad. Hutn.; (84) P 307-10; Vol 40; No 11-12; In Pol; Coden: WIHUA; ISSN: 0043513;
Sections: 154000
Registry No.: 11114-46-8 <manufacture of low carbon, methods for, worldwide>
Mol. Formula: C.Cr.Fe.N.Si
Terms: review low carbon ferrochromium manufacture
CT: nonbase/base/compounds

Quest Accession Number : 02029259
102(04)029259 CHEMABS dissertation
Evaluation of the metallurgical potential of transferred-arc plasma furnaces for ferrochromium production. (Volumes I and II)
Maske, Kurt Ulrich
Univ. Minnesota Minneapolis USA US MN
From: Diss. Abstr. Int. B 1984, 45(5), 1563.
Document type: DISSERTATION; (84) P 54 pp.; In Eng; Avail.: Univ. Microfilms Int., Order No. DA8418511; Coden: DABBB;
Sections: 154002
Registry No.: 11114-46-8 <preparation of, transferred arc plasma furnace for>
Mol. Formula: C.Cr.Fe.N.Si
Terms: ferrochromium transferred arc plasma furnace
CT: FURNACES,electric,<transferred arc plasma, for ferrochromium production>/nonbase/base/compounds

Anexo-5

1989 ANNUAL BOOK OF ASTM STANDARDS

SECTION 1

Iron and Steel Products

ASTM

VOLUME 01.02

Ferrous Castings; Ferroalloys; Shipbuilding

Includes standards of the following committees:

A-1 on Steel, Stainless Steel, and Related Alloys
A-4 on Iron Castings
F-25 on Shipbuilding

Publication Code Number (PCN): 01-010289-01

ASTM 1916 Race Street, Philadelphia, PA 19103-1187 USA ■ (215) 299-5400 ■ TWX: 710-670-1037 ■ FAX: 215-977-9679

Designation: A 101 – 80 (Reapproved 1985)[ε1]

Standard Specification for Ferrochromium[1]

This standard is issued under the fixed designation A 101; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This specification has been approved for use by agencies of the Department of Defense to replace Federal Specification QQ-F-145 and for listing in the DoD Index of Specifications and Standards.

[ε1] NOTE—Section 2 was editorially added and subsequent sections renumbered in July 1985.

1. Scope

1.1 This specification covers two types of ferrochromium designated as high carbon and low carbon, the latter including nitrogen-bearing ana vacuum grades.

1.2 The values stated in inch-pound units are to be regarded as the standard.

2. Referenced Documents

2.1 *ASTM Standards:*

E 29 Recommended Practice for Indicating Which Places of Figures Are to Be Considered Significant in Specified Limiting Values[2]

E 31 Method for Chemical Analysis of Ferroalloys[3]

E 32 Practices for Sampling Ferroalloys and Steel Additives for Determination of Chemical Composition[3]

3. Ordering Information

3.1 Orders for mateiial under this specification shall include the following information:

3.1.1 Quantity,

3.1.2 Name of material,

3.1.3 ASTM designation and year of issue,

3.1.4 Grade,

3.1.5 Size, and

3.1.6 Requirements for packaging analysis reports, etc., as appropriate.

3.2 Although ferrochromium is purchased by total net weight the customary basis of payment is per pound of contained chromium.

4. Chemical Composition

4.1 The various grades shall conform to the requirements as to chemical composition specified in Tables 1 and 2.

4.2 The manufacturer shall furnish an analysis of each shipment showing the elements specified inneTable 1.

4.3 The values shown in Table 2 are expected maximums. Upon request of the purchaser, the manufacturer shall furnish an analysis for any of these elements on a cumulativ basis over a period mutually agreed upon by the manufac turer and the purchaser.

5. Size

5.1 The various grades are available in sizes as listed i Table 3.

5.2 The sizes listed in Table 3 are typical, as shipped fror the manufacturer's plant. These alloys exhibit varying de grees of friability; therefore, some attrition may be expecte in transit, storage, and handling. A quantitative test is no available for rating relative friability of ferroalloys. A coc system has been developed, therefore, for this purpose, and number rating for each product type is shown in the la column of Table 3. Definitions applicable to these coc numbers are given in the Appendix.

6. Sampling

6.1 The material shall be sampled in accordance wi Practices E 32.

6.2 Other methods of sampling mutually agreed upon b the manufacturer and the purchaser may be used; howeve in case of discrepancy, Practices E 32 shall be used f referee.

7. Chemical Analysis

7.1 The chemical analysis of the material shall be made accordance with the procedure for the ferroalloys as c scribed in Method E 31 or alternative methods that will yi equivalent results.

7.2 If alternative methods of analysis are used, in case discrepancy, Method E 31 shall be used for referee.

7.3 Where no method is given in Methods E 31 for t analysis for a particular element, the analysis shall be ma in accordance with a procedure agreed upon by the mar facturer and the purchaser.

8. Inspection

8.1 The manufacturer shall afford the inspector rep senting the purchaser all reasonable facilities, without char to satisfy him that the material is being furnished accordance with this specification.

9. Rejection

9.1 Any claims or rejections shall be made to the ma

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[1] This specification is under the jurisdiction of ASTM Committee A-1 on Steel, Stainless Steel, and Related Alloys and is the direct responsibility of Subcommittee A01.30 on Ferroalloys and Alloying Additives.

Current edition approved Aug. 1, 1980. Published October 1980. Originally published as A 101 – 25 T. Last previous edition A 101 – 73.

[2] *Annual Book of ASTM Standards*, Vol 14.02.

[3] *Annual Book of ASTM Standards*, Vol 03.05.

TABLE 1 Chemical Requirements[A]

Type Ferrochromium	Grade	Chromium	Carbon	Silicon	Sulfur, max	Phosphorus, max	Nitrogen
		Composition, %					
High carbon	A	52.0–58.0	6.0–8.0	6.0 max	0.040	0.030	...
	B	55.0–64.0	4.0–6.0	8.0–14.0	0.040	0.030	...
	C	62.0–72.0	4.0–9.5	3.0 max	0.060	0.030	...
Low carbon	A	60.0–67.0	0.025 max	1.0–8.0	0.025	0.030	...
	B	67.0–75.0	0.025 max	1.0 max	0.025	0.030	...
	C	67.0–75.0	0.050 max	1.0 max	0.025	0.030	...
	D	67.0–75.0	0.75 max	1.0 max	0.025	0.030	...
Vacuum low carbon	E	67.0–72.0	0.020 max	2.0 max	0.030	0.030	...
	F	67.0–72.0	0.010 max	2.0 max	0.030	0.030	...
	G	63.0–68.0	0.050 max	2.0 max	0.030	0.030	5.0–6.0
Nitrogen bearing		62.0–70.0	0.10 max	1.0 max	0.025	0.030	1.0–5.0

[A] For purposes of determining conformance with this specification, the reported analysis shall be rounded to the nearest unit in the last right-hand place of figures used in expressing the limiting value, in accordance with the rounding method of Recommended Practice E 29.

cturer within 45 days from receipt of material by the purchaser.

10. Packaging and Package Marking

10.1 The material shall be packaged in sound containers, or shapped in bulk, in such a manner that none of the product is lost or contaminated in shipment.

TABLE 2 Supplementary Chemical Requirements[A]

Type	High Carbon		Low Carbon	Vacuum Low Carbon[B]		Nitrogen Bearing
Grade	A, B	C	All Grades	E, F	G	—
	Composition, max, %					
Nitrogen	0.050	0.050	0.12	0.050	C	C
Manganese	0.75	0.75	0.75	0.75	0.75	0.75
Nickel	0.50	0.50	0.50	0.50	0.50	0.50
Vanadium	0.50	0.50	0.50	0.50	0.50	0.50
Copper	0.050	0.050	0.050	0.050	0.050	0.050
Molybdenum	0.050	0.050	0.050	0.050	0.050	0.050
Columbium	0.050	0.050	0.050	0.050	0.050	0.050
Tantalum	0.050	0.050	0.050	0.050	0.050	0.050
Cobalt	0.10	0.10	0.10	0.10	0.10	0.10
Aluminum	0.25	0.25	0.10	0.10	0.10	0.10
Titanium	0.50	0.10	0.050	0.050	0.050	0.050
Zirconium	0.050	0.050	0.01	0.01	0.01	0.01
Antimony	0.01	0.01	0.01	0.01	0.01	0.01
Arsenic	0.005	0.005	0.005	0.005	0.005	0.005
Lead	0.005	0.005	0.005	0.005	0.005	0.005
Tin	0.005	0.005	0.005	0.005	0.005	0.005
Zinc	0.005	0.005	0.005	0.005	0.005	0.005
Boron	0.005	0.005	0.005	0.005	0.005	0.005
Silver	0.005	0.005	0.005	0.005	0.005	0.005
Bismuth	0.005	0.005	0.005	0.005	0.005	0.005

[A] For purposes of determining conformance with this specification, the reported analysis shall be rounded to the nearest unit in the last right-hand place of figures used in expressing the limiting value, in accordance with the rounding method of Recommended Practice E 29.
[B] The inert oxide (SiO_2 + CaO + MgO + Al_2O_3) content of vacuum low-carbon ferrochromium shall be specified as 3.50% max.
[C] See Table 1.

TABLE 3 Standard Sizes and Tolerances

Product	Standard Sizes	Tolerances		Friability Ratings
Ferrochromium:				
High-carbon	8 in. (200 mm) by 4 in. (100 mm)	10 in. (250 mm), max	10 %, max, passing 4-in. (100-mm) sieve	4
	6 in. (150 mm) by down	10 %, max, retained on 6-in. (150-mm) sieve		
	5 in. (125 mm) by 2 in. (50 mm)	10 %, max, retained on 5-in. (125-mm) sieve	10 %, max, passing 2-in. (50-mm) sieve	
	4 in. (100 mm) by ½ in. (12.5 mm)	10 %, max, retained on 4-in. (100-mm) sieve	10 %, max, passing ½-in. (12.5-mm) sieve	
	3 in. (75 mm) by 1 in. (25 mm)	10 %, max, retained on 3-in. (75-mm) sieve	10 %, max, passing 1-in. (25-mm) sieve	
	3 in. (75 mm) by ¼ in. (6.3 mm)	10 %, max, retained on 3-in. (75-mm) sieve	10 %, max, passing ¼-in. (6.3-mm) sieve	
	¼ in. (6.3 mm) by down	5 %, max, retained on ¼-in. (6.3-mm) sieve		
	8 mesh (2.36 mm) by down	5 %, max, retained on U.S. No. 8 (2.36-mm) sieve		
Low-carbon	8 in. (200 mm) by down	10 in. (250 mm), max		1
	8 in. (200 mm) by 4 in. (100 mm)	10 %, max, retained on 8-in. (200-mm) sieve	5 %, max, passing 4-in. (100-mm) sieve	
	4 in. (100 mm) by down	10 %, max, retained on 4-in. (100-mm) sieve		
	3 in. (75 mm) by 1 in. (25 mm)	10 %, max, retained on 3-in. (75-mm) sieve	10 %, max, passing 1-in. (25-mm) sieve	
	8 mesh (2.36 mm) by down	5 %, max, retained on U.S. No. 8 (2.36-mm) sieve		
Vacuum low carbon	brick or pellet	designated by manufacturer		

APPENDIX

(Nonmandatory Information)

X1. FRIABILITY RATINGS

Code No.	Definition
1	Very tough materials which are susceptible to little, if any, breakage during shipment or handling. (Example: low carbon ferrochrome)
2	Some breakage of large pieces probable in shipping and handling. No appreciable fines produced from either lump or crushed sizes. (Example: chromium metal)
3	Appreciable reduction in size of large pieces possible in shipping and handling. No appreciable production of fines in handling of crushed sizes. (Example: ferrovanadium)
4	Appreciable reduction in size of large pieces upon repeated handling. Some fines produced upon repeated handling of crushed sizes. (Example: standard ferromanganese)
5	Appreciable reduction in size in repeated handling of large pieces. Appreciable fines may be produced in the handling of crushed sizes. (Example: 50 % ferrosilicon)
6	This category represents the most friable alloys. (Example: calcium silicon)

Standard Specification for Ferrochrome-Silicon[1]

This standard is issued under the fixed designation A 482; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers two grades of ferrochrome-silicon designated A and B.

2. Ordering Information

2.1 Orders for material under this specification shall include the following information:

2.1.1 Quantity,

2.1.2 Name of material,

2.1.3 ASTM designation,

2.1.4 Grade,

2.1.5 Size, and

2.1.6 Requirements for packaging, analysis reports, etc., as appropriate.

2.2 The basis of payment for ferrochrome-silicon may be per unit weight of alloy or per pound of contained chrome and silicon.

3. Chemical Requirements

3.1 The various grades shall conform to the requirements as to chemical composition specified in Tables 1 and 2.

3.2 The manufacturer shall furnish an analysis of each shipment showing the elements specified in Table 1.

3.3 The values shown in Table 2 are expected maximums. Upon request of the purchaser, the manufacturer shall furnish an analysis for any of these elements on a cumulative basis over a period mutually agreed upon between the manufacturer and the purchaser.

4. Size

4.1 The various grades are available in sizes as listed in Table 3.

4.2 The sizes listed in Table 3 are typical as shipped from the manufacturer's plant. These alloys exhibit varying degrees of friability; therefore, some attrition may be expected in transit, storage, and handling. A quantitative test is not available for rating relative friability of ferroalloys. A code system has been developed, therefore, for this purpose, and a number rating each product type is shown in the last column of Table 3. Definitions applicable to these code numbers are given in the Appendix.

[1] This specification is under the jurisdiction of ASTM Committee A-1 on Steel, Stainless Steel, and Related Alloys and is the direct responsibility of Subcommittee A01.30 on Ferroalloys and Alloying Additives.

Current edition approved March 26, 1976. Published May 1976. Originally published as A 482 – 63 T. Last previous edition A 482 – 66 (1971).

TABLE 1 Chemical Requirements

Element	Composition, %	
	Grade A	Grade B
Chromium	34.0–38.0	38.0–42.0
Carbon, max	0.060	0.050
Silicon	38.0–42.0	41.0–45.0
Sulfur, max	0.030	0.030
Phosphorus, max	0.030	0.030

5. Sampling

5.1 The material shall be sampled in accordance with ASTM Practices E 32, Sampling Ferroalloys and Steel Additives for Determination of Chemical Composition.[2]

5.2 Other methods of sampling mutually agreed upon by the manufacturer and by the purchaser may be used; however, in case of discrepancy, Practices E 32 shall be used for referee.

6. Chemical Analysis

6.1 The chemical analysis of the material shall be made in accordance with the procedure for the ferroalloys as described in ASTM Methods E 31, Chemical Analysis of Ferroalloys,[2] or alternative methods which will yield equivalent results.

[2] *Annual Book of ASTM Standards*, Vol 03.05.

TABLE 2 Supplementary Chemical Requirements[A]

Element	Composition, max, percent Ferrochrome-Silicon (Grades A and B)
Nitrogen	0.050
Manganese	0.75
Nickel	0.50
Vanadium	0.50
Copper	0.050
Molybdenum	0.050
Columbium	0.050
Tantalum	0.050
Cobalt	0.10
Aluminum	0.50
Titanium	0.50
Zirconium	0.050
Arsenic	0.005
Lead	0.005
Tin	0.005
Zinc	0.005
Boron	0.005
Antimony	0.005
Silver	0.005
Bismuth	0.005

[A] For purposes of determining conformance with this specification, the reported analysis shall be rounded to the nearest unit in the right-hand place of figures used in expressing the limiting value, in accordance with the rounding method of Recommended Practice E 29 (*Annual Book of ASTM Standards*, Vol 14.02).

TABLE 3 Standard Sizes and Tolerances

Product	Standard Sizes	Tolerances [A]	
Ferrochrome-Silicon	75 lb by down	90 lb lump, max	
	75 lb by 1 in. (25.4 mm)	90 lb lump, max	10% max, passing 1-in. (25.0-mm) sieve
	75 lb by 2 in. (50.8 mm)	90 lb lump, max	10% max, passing 2-in. (50-mm) sieve
	40 lb by down	50 lb lump, max	
	25 lb by down	30 lb lump, max	
	4 in. (101.6 mm) by down	10% max, retained on 4-in. (100-mm) sieve	
	3 in. (76.2 mm) by down	10% max, retained on 3 in. (75-mm) sieve	
	3 by ½ in. (76.2 by 12.7 mm)	10% max, retained on 3-in. (75-mm) sieve	10% max, passing ½ in. (12.5 mm) sieve
	2 in. (50.8 mm) by down	10% max, retained on 2-in. (50-mm) sieve	
	2 by ¼ in. (50.8 by 6.35 mm)	10% max, retained on 2-in. (50-mm) sieve	10% max, passing ¼ in. (6.3-mm) sieve
	¾ in. (19.05 mm) by down	10% max, retained on ¾ in. (19.0-mm) sieve	

[A] Specifications of sieve sizes used to define tolerances herein are as listed in ASTM Specifications E 11, for Wire-Cloth Sieves for Testing Purposes (*Annual Book of ASTM Standards*, Vol 14.02).

6.2 If alternative methods of analysis are used, in case of discrepancy, Methods E 31 shall be used for reference.

6.3 Where no method is given in Methods E 31 for the analysis of a particular element, the analysis shall be made in accordance with a procedure agreed upon between the manufacturer and the purchaser.

7. Packaging

7.1 The material shall be packaged in sound containers, or shipped in bulk, in such a manner that none of the product is lost or contaminated in shipment.

8. Inspection

8.1 The manufacturer shall afford the inspector representing the purchaser all reasonable facilities, without charge, to satisfy him that the material is being furnished in accordance with this specification.

9. Rejection

9.1 Any claims or rejections shall be made to the manufacturer within 45 days from receipt of material by the purchaser.

APPENDIX

(Nonmandatory Information)

X1. FRIABILITY RATINGS

Code No.	Definition
1	Very tough materials which are susceptible to little, if any, breakage during shipment or handling. (Example: low-carbon ferrochrome)
2	Some breakage of large pieces probable in shipping and handling. No appreciable fines produced from either lump or crushed sizes. (Example: chrome metal)
3	Appreciable reduction in size of large pieces possible in shipping and handling. No appreciable production of fines in handling of crushed sizes. (Example: ferrovanadium)
4	Appreciable reduction in size of large pieces upon repeated handling. Some fines produced upon repeated handling of crushed sizes. (Example: Standard ferromanganese)
5	Appreciable reduction in size in repeated handling of large pieces. Appreciable fines may be produced in the handling of crushed sizes. (Example: 50 percent ferrosilicon)
6	This category represents the most friable alloys. (Example: calcium-silicon)

Table 8. Comparison of the chemical composition of ferrochromium ISO 5448 and DIN 17 565 [81]

Designation	% Cr		% C		% Si		% P max		% S max	
	DIN	ISO	DIN	ISO	DIN	ISO	DIN	ISO	DIN	ISO
FeCr 70 C 5	60 - 72	-	4.0 - 6.0	-	< 1.5	-	0.030	-	0.050	-
FeCr 50 60 70 C 50	-	45 - 75[a]	-	4.0 - 6.0	-	< 1.5	-	0.050	-	0.10
FeCr 50 60 70 LSLP		45 - 75[a]	-	4.0 - 6.0	-	< 1.5		0.030		0.05
FeCr 70 C	65 - 75	-	0.5 - 4.0[b]		< 1.5		0.030		0.050	-
FeCr 50 60 70 C	-	45 - 75[a]	-	0.5 - 4.0[b]	-	< 1.5		0.050	-	0.050
FeCr 70 C[c]	65 - 75	-	0.01 - 0.50[d]	-	< 1.5	-	0.030	-	0.010	-
FeCr 50 60 70 C[c]	-	45 - 75[a]	-	0.015 - 0.50[e]	-	< 1.5	-	0.050	-	0.030

[a] FeCr 50 means 45 - 55% Cr, FeCr 60 means 55 - 65% Cr, FeCr 70 means 65 - 75% Cr. [b] In four grades. [c] 0.15% [d] In seven grades. [e] In six grades.

Table 9. [illegible] of the chemical composition of ferrosilicoch[illegible] ISO 5449 and DIN 17 565 [81]

Designation	% Cr		% Si		% C max.		% P max		% S max	
	DIN	ISO	DIN	ISO	DIN	ISO	DIN	ISO	DIN	ISO
FeCrSi 15		> 55.0		10.0 - 18.0		6.0		0.050	-	0.030
FeCrSi 20 22	55 - 65	> 55.0	25 - 20	20.0 - 25.0	0.050	0.05	0.020	0.030	0.010	0.030
FeCrSi 23		> 45.0		18.0 - 28.0		3.5		0.050		0.030
FeCrSi 26		> 45.0		24.0 - 28.0		1.5		0.030		0.030
FeCrSi 33		> 43.0		28.0 - 38.0		1.0		0.050		0.030
FeCrSi 40	40 - 45	> 35.0	45 - 35	35.0 - 40.0	0.050	0.2	0.020	0.030	0.010	0.030
FeCrSi 45		> 28.0		40.0 - 45.0		0.1		0.030	-	0.030
FeCrSi 50 LC		> 20.0		45.0 - 60.0	-	0.05	-	0.030	-	0.030
FeCrSi 55		> 28.0		50.0 - 55.0		0.03		0.030	-	0.030
FeCrSi 48 LP	-	> 35.0		42.0 - 55.0		0.05	-	0.020	-	0.010

Table 10. Special and nonstandardized ferrochromium and ferrosilicochromium alloys

Trade name	Analysis, wt%							Producer
	Cr	C	Si	P	S	N	Co	
Charge chrome[a]	53 - 58	5 - 8	6 - 3	-	-	-	-	-
EHC ferro-chromium	min. 66	min. 9.0	0.5 1.0	max. 0.03	max. 0.05	-	-	GfE/EW[b]
Simplex ferro-chromium	ca. 70	max. 0.01	ca. 1.0	-	-	-	-	Union C: bide/Elke
LCN ferro-chromium	ca. 70	max. 0.05	max. 1.5	-	-	max. 0.020	-	GfE/EW[b]
LCNSi ferro-chromium	ca. 70	{max. 0.05 {max. 0.03	max. 0.30 max. 0.20	-	-	max. 0.020	-	GfE/EW[b]
Ferrochromium reactor grade	80 - 85	{max. 0.06 {max. 0.05	max. 2.5 max. 1.50			max. 0.20	max. 0.02	ABF/FT[c]
Cromax-90 chrome	85 - 90	max. 0.10 max. 0.06 max. 0.03	max. 2.0 max. 1.0 max. 0.5	max. 0.020 max. 0.015 min. 0.007	max. 0.020 max. 0.015 min. 0.007	0.03 - 0.05 - -	0.01 - 0.02 - -	Showa Denko
Silicochrom 40	35 - 40	max. 0.05	35 - 40	max. 0.03	-	-	-	GfE/EW[b]
Silicochrom 60	55 - 65	max. 0.05	20 - 25	max. 0.03	-	-	-	GfE/EW[b]

[a] Alloy has no definite specification. [b] Gesellschaft für Elektrometallurgie/Elektrowerk Weisweiler. [c] Aktiebola Ferrolegeringar Trollhätteverken

ANEXO-6

informe n.° 101-G

asunto:

ASESORIA AL CENTRO DE INVESTIGACIONES SIDERURGICAS EN LA PRODUCCION DE FERROALEACIONES

INFORME PRELIMINAR. CONTRATO Nº. 91/101 G

peticionario: ONUDI

I. PLANTEAMIENTO

La ONUDI ha solicitado al Centro Nacional de Investigaciones Metalúrgicas de España (CENIM), la prestación de servicios técnicos y tecnológicos para apoyar el desarrollo de la actividad metalúrgica de la UNIMET del Ministerio de la Industria Sidero Mecánica de la República de Cuba, en los aspectos relacionados con la obtención de ferroaleaciones a partir de materias primas nacionales, utilizables en la producción de aceros inoxidables y la capacitación de técnicos en dicha esfera.

A tales efectos el CENIM ha organizado el trabajo de la siguiente forma:

1. Análisis y evaluación de conjunto con los técnicos cubanos, de los trabajos realizados en Cuba relacionados con la producción de ferroaleaciones con materias primas domésticas.

2. Estudio bibliográfico sobre la producción de ferroaleaciones base cromo y el uso del plasma en la misma.

3. Realización de pruebas de laboratorio para la obtención de ferroaleaciones en el horno de plasma térmico de 150 Kw del CENIM.

4. Organización y realización de actividades de entrenamiento en la técnica del plasma térmico para los técnicos cubanos, así como gira de estudios por diferentes plantas productoras de ferroaleaciones en Europa.

II. TRABAJO EJECUTADO

PUNTO 1:

Según la planificación prevista, entre los dias 19 a 28 de septiembre del año en curso, viajaron a Cuba los señores Dr. José Luis Enriquez y Dr Alejandro Cores los cuales fueron atendidos directamente por el Dr. Guillermo Jiménez y el Ing. Orlando Castaño.

El Dr. Guillermo Jiménez, en dos sesiones de trabajo, ofreció una explicación de los trabajos de investigación ejecutados con minerales cubanos para la obtención de ferrocromo, ferrocromoníquel, ferromanganeso, sílicomanganeso y ferrosilicio así como respondió a las preguntas formuladas por los técnicos españoles.

Se efectuó un viaje a la sede del CIS en Nicaro, provincia de Holguín, donde se explicó el proyecto de producción de ferroaleaciones base cromo y manganeso a partir de recursos mineros cubanos.

Se visitó el "Taller de Ferroaleaciones" en construcción de Cajimaya (antigua fábrica de cemento), y la base minera para su puesta en marcha.- Taller de beneficio de cromitas de "Cayo Guan", Moa, minas de mineral laterítico de "Pinares de Mayari" y Planta Piloto de beneficio de colas en Nícaro

De las visitas efectuadas en cuba se pueden hacer las siguientes conclusiones:

- Las materias primas cubanas presentan características no comunes con sus homólogas internacionales, por tanto, las soluciones técnicas para su elaboración en condiciones de bloqueo son atípicas.

- La concepción investigadora que ha llevado el SIME para el desarrollo de tecnologías de producción de ferroaleaciones, con materias primas domésticas, es coherente y adecuada.

- El empleo de cromitas, fuera de balance por su alto contenido de sílice, para la obtención de ferrosilicocromo es de gran perspectiva y aumentaría considerablemente las reservas cubanas de cromitas.

- Se deben organizar pruebas de laboratorio para la obtención de ferrosílicocromo a partir de cromitas cubanas en el horno de plasma del CENIM, para lo cual se necesita la preparación y traslado a España de aproximadamente 200 Kg de cromita.

- El CIS no cuenta con la base material que permita la ejecución de investigaciones a escala semindustrial. Su "Planta de Ferroaleaciones", en construcción en Cajimaya, no posee el agregado principal para su funcionamiento, un "Horno de arco eléctrico" para la fusión reductora de minerales con potencia de 2000 KVa.

- El equipamiento solicitado por el CIS, si bién es necesario y de gran utilidad, tiene un precio de venta muy superior al presupuesto ofrecido por la ONUDI de 7000 dólares USA.

  Con ese presupuesto proponemos se compren en Cuba, a menor precio, el siguiente listado de ordenadores y sus accesorios para modelación matemática de procesos metalúrgicos y procesamiento rápido de información científico-técnica:

ORDENADORES Y ACCESORIOS	EQUIPO	UNIDADES	TOTAL
Computadora Kenitec System 286 + 1 MB M6P	945,00	3	2835
Monitor CGA 4646	236,00	3	708
Printer EPSON FX-1050	550,00	1	550
Impresora LX 810	245,00	2	490
Torres disco 3½" 1,2MB	99,00	2	198
Estabilizador de voltaje LS-604 (600 W)	113,00	3	339
Discos flexibles alta densidad 5¼"		100	
Discos flexibles doble densidad 5¼"		100	
Discos flexibles alta densidad 3½"		100	

TOTAL ...... -- -- 5.120 $ USA

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PUNTO 2:

Se realizó un estudio bibliográfico actualizado al año 1991 sobre la producción de ferrocromo y otras ferroaleaciones base cromo, utilizables en la producción de aceros inoxidables, así como al empleo del plasma térmico en la producción de ferroaleaciones que consta con más de 50 títulos, de los cuales se dispone de algunos y otros están solicitados a instituciones de otros paises.

PUNTO 3:

Fue trasladada hasta el CENIM una muestra de mineral de cromita cubana de 100 Kg y preparada para su elaboración.

Se efectuaron los cálculos de carga correspondientes a la ejecución de cuatro fusiones de ferrocromo con alto y bajo contenido de silicio en el horno de plasma de 150 kw del CENIM. Los metales y escorias obtenidos fueron enviados a los laboratorios de análisis químico y otras caracterizaciones para su estudio. Se dispone de algunos resultados parciales, y próximamente se tendrá completa esta información.

III. CONTINUACION DEL PROYECTO

La continuación de las actividades del proyecto prevé una gira de estudios durante seis semanas para el entrenamiento de los señores Guillermo Jiménez y Orlando Castaño por talleres productores de ferroaleaciones de diferentes firmas radicadas en España, Francia, Alemania e Italia con las cuales debemos aun contactar para establecer el cronograma de visitas.

Por estas razones solicitamos a las autoridades de ONUDI en la Habana, que apoyen la adquisición de las respectivas visas de entradas a esos paises de los señores antes mencionados para poder comenzar la gira el 1º de febrero de 1992.

Motivado por los problemas de financiamiento del proyecto en su conjunto, que precisó el aplazamiento de sus acciones hasta el mes de febrero de 1992, nos vemos obligados a postergar la entrega del informe final hasta la 2ª. quincena del mes de marzo de 1992, una vez finalizada todas las acciones previstas en el proyecto.

Madrid, 18 de noviembre de 1991

Han intervenido en la elaboración de este informe,

Alberto Isidro   Alejandro Cores   José L. Enríquez

Vº. Bº.

Antonio Formoso
Jefe UEI de Siderurgia