

ISI

INDUSTRIAL SOLUTIONS INTERNATIONAL

Copper Melting Applications



*133 Milliken Creek Drive, Napa, California 94558
Phone +1 707 255 5003 Fax +1 707-255-1129*

*Email: indsoli@sbcglobal.net
Web: indsolllc.com*



Industrial Solutions International is a long established company focussed on the supply of refractory materials to the energy consuming industries. From its many resources worldwide Industrial Solutions International are able to supply a vast range of materials either as formed shapes or monolithics.

Recently Industrial Solutions International has exclusively acquired the manufacturing rights to the complete range of basic refractories previously manufactured by Dyson Refractories in the United Kingdom. This technology is to be utilised by Industrial Solutions International in conjunction with its manufacturing partners to continue and develop the magnesite and magnesite – chrome product lines.

PRODUCT DEVELOPMENT

In order to provide quality products, Industrial Solutions International deliver to their market, materials of the highest quality consistent with a competitive price, backed by the expertise of application knowledge.

Industrial Solutions International operate a policy of continuous product development which from time to time results in the introduction of new products or modifications to existing products.

Product development is both proactive and reactive in that new materials and technologies are constantly reviewed and where appropriate, incorporated into the various manufacturing units. In parallel, cognisance is taken of material performance in the many and varied industries where Industrial Solutions International products are utilised. Wherever possible either material properties or design will be tailored to meet the requirements of a given application.

TECHNICAL SUPPORT

Technical support to the Industrial Solutions International range of products is provided by the intensive research and development facilities associated with manufacture. Selection of materials is made by reference to an extensive application database, which in conjunction with close liaisons with end users provides materials offering optimum performance in terms of cost and operation

*133 Milliken Creek Drive, Napa, California 94558
Phone +1 707 255 5003 Fax +1 707-255-1129*

*Email: indsoli@sbcglobal.net
Web: indsolllc.com*



INDUSTRIAL SOLUTIONS INTERNATIONAL - Technical Office

COPPER

OVERVIEW

Copper smelting has changed radically during the twentieth century, the most significant being the development of flash smelters by both INCO and OUTOKUMPU, and continuous processes by NORANDA and MITSUBISHI.

The bulk of copper smelting, 2,000,000 tonnes, is produced using flash smelters, compared with 1,700,000 tonnes by reverberatory furnace, using only half the number of reverberatory furnaces.

Flash furnaces have major benefits over reverberatory furnaces, particularly in fuel efficiency, and increased yield.

THE SMELTING PROCESS

Primary smelting vessels, whether they are flash furnaces, ISA furnaces, reverberatory furnaces or electric arc furnaces all subject the refractory lining to attack by slag and sulphur gases. The slag composition is normally high in Fe_2O_3 and SiO_2 , both of which attack magnesia in the refractory to form magnesio-ferrite, and Forsterite, whilst the sulphur present in the vapour phase also attacks magnesia to form magnesium sulphate. All reactions in the refractory system are accompanied by volume expansion, leading to crack formation behind the working face, which are then lost during temperature cycling.

Direct bonded Chrome - magnesite refractories are the preferred materials in contact with copper slags, owing to their greater tolerance to acidic slags, by limitation of free magnesia.

Improved products based upon presintered clinker and/or fused grain clinkers show further benefit in the most arduous applications.

THE CONVERTER

The copper converter carries similar slags to those found in the smelting process, together with sulphurous gases, and consequently similar modes of refractory attack take place. Preferential wear frequently takes place at the tuyere line of the converter owing to the combination of slag attack and thermal shock, in this area high hot strength chrome - magnesite with good thermal shock resistance are a prerequisite.



INDUSTRIAL SOLUTIONS INTERNATIONAL - Technical Office

ANODE FURNACE

There is little slag present in the Anode furnace, but the refractory lining is in contact with highly penetrative molten copper and cuprous oxide. Penetration of the refractory material with copper leads to disruptive failure owing to crack formation at the limit of penetration. Reaction between copper oxide and silica in the refractory leads to the formation of low melting point compounds that exacerbate the formation of cracks, and loss of the working face.

The working environment of the Anode furnace demands a chrome - magnesite material with high hot strength and tight texture in order to minimise copper penetration and subsequent disruptive loss of the working face.

SLAG - CLEANING FURNACE

The slag cleaning furnace has special requirements depending upon the slag practice.

With a frozen slag practice, as the name implies, it is necessary to maintain a frozen slag layer on the refractory lining, requiring a highly conductive refractory lining.

Direct bonded Magnesite - chrome materials with good hot strength are the preferred refractory lining. Practices using an 'active molten slag layer' require a refractory material with good slag and penetration resistance. Direct bonded Chrome - magnesite materials perform well in this application.



Product Data Sheet

Product Description	Dymax AN	
	Direct bonded magnesite chrome based on high Cr ₂ O ₃ content fused magnesite chrome grain	
	SI	Imperial
Chemical Analysis (%)		
SiO ₂		2.10
Fe ₂ O ₃		11.0
Al ₂ O ₃		7.5
Cr ₂ O ₃		19.5
CaO		1.3
MgO		59.0
Physical Properties		
Apparent Porosity (%)		15.5
Bulk Density (g/ml) (lb/ft ³)	3.24	201.9
Cold Crushing Strength (MN/m ²) (lb/in ²)	60	8700
Permanent Linear Change on Reheating (%)		
2h @1700°C		0.1
Modulus of Rupture (MN/m²) (lb/in²)		
0025°C	12	1740
1400°C (2552°F)	9	1305
1500°C		
Reversible Thermal Expansion (%)		
20 - 1000°C		0.95
20 - 1200°C		1.25
20 - 1400°C		1.5
Thermal Conductivity (w/mK) (BTU ft²h°F)		
Mean Temperature 500°C	4.8	22.3
Mean Temperature 700°C	4.3	29.8
Mean Temperature 900°C	4.0	27.7
Mean Temperature 1300°C	3.5	24.3

Date of Issue January 05, 2007

Version 01

The data presented are typical, and not contractual conditions of acceptance. The data presented are average values obtained by laboratory testing of production volumes. The extent and frequency of such testing is defined by the internal procedures of the Quality Management System according to EN ISO 9001:2000 standard.

All rights are reserved to make modifications and updates to the presented data.



Product Data Sheet

Product Description	Dymax BP	
	Direct bonded magnesite chrome based on high Cr ₂ O ₃ content fused magnesite chrome grain	
	SI	Imperial
Chemical Analysis (%)		
SiO ₂		1.90
Fe ₂ O ₃		11.0
Al ₂ O ₃		8.50
Cr ₂ O ₃		21.5
CaO		1.1
MgO		55.0
Physical Properties		
Apparent Porosity (%)		16.0
Bulk Density (g/ml) (lb/ft ³)	3.24	201.9
Cold Crushing Strength (MN/m ²) (lb/in ²)	60	8700
Permanent Linear Change on Reheating (%)		
2h @1700°C		0.2
Modulus of Rupture (MN/m²) (lb/in²)		
0025°C	9.5	1378
1400°C (2552°F)	6.5	943
1500°C		
Reversible Thermal Expansion (%)		
20 - 1000°C		0.95
20 - 1200°C		1.25
20 - 1400°C		1.5
Thermal Conductivity (w/mK) (BTU ft²h°F)		
Mean Temperature 500°C	4.1	28.4
Mean Temperature 700°C	4.0	27.7
Mean Temperature 900°C	3.9	27.0
Mean Temperature 1300°C	3.6	25.0

Date of Issue January 05, 2007

Version 01

The data presented are typical, and not contractual conditions of acceptance. The data presented are average values obtained by laboratory testing of production volumes. The extent and frequency of such testing is defined by the internal procedures of the Quality Management System according to EN ISO 9001:2000 standard.

All rights are reserved to make modifications and updates to the presented data.



Product Data Sheet

Product Description	Dymax CQ	
	Direct bonded magnesite chrome based on high Cr ₂ O ₃ content presintered clinker	
	SI	Imperial
Chemical Analysis (%)		
SiO ₂		1.95
Fe ₂ O ₃		13.0
Al ₂ O ₃		7.0
Cr ₂ O ₃		19.0
CaO		1.2
MgO		57.5
Physical Properties		
Apparent Porosity (%)		17.5
Bulk Density (g/ml) (lb/ft ³)	3.16	197.3
Cold Crushing Strength (MN/m ²) (lb/in ²)	55	7975
Permanent Linear Change on Reheating (%)		
2h @1700°C		0
Modulus of Rupture (MN/m²) (lb/in²)		
0025°C	14	2030
1400°C (2552°F)	8	1160
1500°C	7	1015
Reversible Thermal Expansion (%)		
20 - 1000°C		1.0
20 - 1200°C		1.2
20 - 1400°C		1.4
Thermal Conductivity (w/mK) (BTU ft²h°F)		
Mean Temperature 500°C	3.8	26.4
Mean Temperature 700°C	3.6	25.0
Mean Temperature 900°C	3.2	20.5
Mean Temperature 1300°C	2.9	18.5

Date of Issue January 05, 2007

Version 01

The data presented are typical, and not contractual conditions of acceptance. The data presented are average values obtained by laboratory testing of production volumes. The extent and frequency of such testing is defined by the internal procedures of the Quality Management System according to EN ISO 9001:2000 standard.

All rights are reserved to make modifications and updates to the presented data.



Product Data Sheet

Product Description	Dymax DR	
	Direct bonded magnesite chrome based on high Cr ₂ O ₃ content presintered clinker	
	SI	Imperial
Chemical Analysis (%)		
SiO ₂		1.85
Fe ₂ O ₃		13.0
Al ₂ O ₃		8.0
Cr ₂ O ₃		21.0
CaO		1.25
MgO		54.6
Physical Properties		
Apparent Porosity (%)		18.5
Bulk Density (g/ml) (lb/ft ³)	3.17	197.9
Cold Crushing Strength (MN/m ²) (lb/in ²)	45	6525
Permanent Linear Change on Reheating (%)		
2h @1700°C		0
Modulus of Rupture (MN/m²) (lb/in²)		
0025°C	12	1740
1400°C (2552°F)	7	1015
1500°C		
Reversible Thermal Expansion (%)		
20 - 1000°C		0.9
20 - 1200°C		1.1
20 - 1400°C		1.4
Thermal Conductivity (w/mK) (BTU ft²h°F)		
Mean Temperature 500°C	3.5	24.3
Mean Temperature 700°C	3.4	23.6
Mean Temperature 900°C	3.1	21.5
Mean Temperature 1300°C	2.9	20.2

Date of Issue January 05, 2007

Version 01

The data presented are typical, and not contractual conditions of acceptance. The data presented are average values obtained by laboratory testing of production volumes. The extent and frequency of such testing is defined by the internal procedures of the Quality Management System according to EN ISO 9001:2000 standard.

All rights are reserved to make modifications and updates to the presented data.



Product Data Sheet

Product Description	Dymax FT	
	Direct bonded magnesite chrome based on high Cr ₂ O ₃ content fused grain with chrome boost	
	SI	Imperial
Chemical Analysis (%)		
SiO ₂		1.20
Fe ₂ O ₃		7.1
Al ₂ O ₃		5.2
Cr ₂ O ₃		21.8
CaO		0.7
MgO		64.0
Physical Properties		
Apparent Porosity (%)		16.0
Bulk Density (g/ml) (lb/ft ³)	3.20	199.4
Cold Crushing Strength (MN/m ²) (lb/in ²)	50	7250
Permanent Linear Change on Reheating (%)		
2h @1700°C		0.1
Modulus of Rupture (MN/m²) (lb/in²)		
0025°C	11	1595
1400°C (2552°F)	10	1450
1500°C		
Reversible Thermal Expansion (%)		
20 - 1000°C		1.0
20 - 1200°C		1.1
20 - 1400°C		1.3
Thermal Conductivity (w/mK) (BTU ft²h°F)		
Mean Temperature 500°C	3.6	25.0
Mean Temperature 700°C	3.7	25.6
Mean Temperature 900°C	3.8	26.3
Mean Temperature 1300°C	3.9	27.0

Date of Issue January 05, 2007

Version 01

The data presented are typical, and not contractual conditions of acceptance. The data presented are average values obtained by laboratory testing of production volumes. The extent and frequency of such testing is defined by the internal procedures of the Quality Management System according to EN ISO 9001:2000 standard.

All rights are reserved to make modifications and updates to the presented data.



Product Data Sheet

Product Description	Dymax GU	
	Direct bonded magnesite chrome based on high Cr ₂ O ₃ content fused grain with chrome boost	
	SI	Imperial
Chemical Analysis (%)		
SiO ₂		1.90
Fe ₂ O ₃		11.0
Al ₂ O ₃		7.0
Cr ₂ O ₃		23.0
CaO		1.10
MgO		57.0
Physical Properties		
Apparent Porosity (%)		17.0
Bulk Density (g/ml) (lb/ft ³)	3.30	206.0
Cold Crushing Strength (MN/m ²) (lb/in ²)	65	9425
Permanent Linear Change on Reheating (%)		
2h @1700°C		0
Modulus of Rupture (MN/m²) (lb/in²)		
0025°C	10	1450
1400°C (2552°F)	8	1160
1500°C	5	725
Reversible Thermal Expansion (%)		
20 - 1000°C		0.95
20 - 1200°C		1.25
20 - 1400°C		1.5
Thermal Conductivity (w/mK) (BTU ft²h°F)		
Mean Temperature 500°C	4.0	27.8
Mean Temperature 700°C	3.7	25.6
Mean Temperature 900°C	3.7	25.6
Mean Temperature 1300°C	3.3	22.9

Date of Issue January 05, 2007

Version 01

The data presented are typical, and not contractual conditions of acceptance. The data presented are average values obtained by laboratory testing of production volumes. The extent and frequency of such testing is defined by the internal procedures of the Quality Management System according to EN ISO 9001:2000 standard.

All rights are reserved to make modifications and updates to the presented data.



Product Data Sheet

Product	Dymax JX	
Description	Direct bonded magnesite chrome based on high Cr ₂ O ₃ content fused grain with chrome boost	
	SI	Imperial
Chemical Analysis (%)		
SiO ₂		1.90
Fe ₂ O ₃		11.5
Al ₂ O ₃		7.5
Cr ₂ O ₃		26.0
CaO		1.10
MgO		53.0
Physical Properties		
Apparent Porosity (%)		15.5
Bulk Density (g/ml) (lb/ft ³)	3.30	206
Cold Crushing Strength (MN/m ²) (lb/in ²)	65	9425
Permanent Linear Change on Reheating (%)		
2h @1700°C		0
Modulus of Rupture (MN/m²) (lb/in²)		
0025°C	9	1450
1400°C (2552°F)	6	1160
1500°C	4.5	653
Reversible Thermal Expansion (%)		
20 - 1000°C		0.95
20 - 1200°C		1.25
20 - 1400°C		1.5
Thermal Conductivity (w/mK) (BTU ft²h°F)		
Mean Temperature 500°C	4.1	28.4
Mean Temperature 700°C	4.0	27.7
Mean Temperature 900°C	3.9	27.0
Mean Temperature 1300°C	3.5	24.3

Date of Issue January 05, 2007

Version 01

The data presented are typical, and not contractual conditions of acceptance. The data presented are average values obtained by laboratory testing of production volumes. The extent and frequency of such testing is defined by the internal procedures of the Quality Management System according to EN ISO 9001:2000 standard.

All rights are reserved to make modifications and updates to the presented data.



Product Data Sheet

Product Description	Dybond 55 Direct bonded magnesite chrome.	
	SI	Imperial
Chemical Analysis (%)		
SiO ₂		1.9
Fe ₂ O ₃		11.0
Al ₂ O ₃		5.0
Cr ₂ O ₃		22.0
CaO		0.9
MgO		59.0
Physical Properties		
Apparent Porosity (%)		18.0
Bulk Density (g/ml) (lb/ft ³)	3.10	193.1
Cold Crushing Strength (MN/m ²) (lb/in ²)	45	6525
Permanent Linear Change on Reheating (%)		
2h @1700°C		0.3
Modulus of Rupture (MN/m²) (lb/in²)		
0025°C	9.0	1305
1400°C (2552°F)	6.0	870
1500°C		
Reversible Thermal Expansion (%)		
20 - 1000°C		0.8
20 - 1200°C		1.0
20 - 1400°C		1.3
Thermal Conductivity (w/mK) (BTU ft²h°F)		
Mean Temperature 500°C	2.2	15.3
Mean Temperature 700°C	2.1	14.6
Mean Temperature 900°C	2.0	13.9
Mean Temperature 1300°C	1.7	11.8

Date of Issue January 05, 2007

Version 01

The data presented are typical, and not contractual conditions of acceptance. The data presented are average values obtained by laboratory testing of production volumes. The extent and frequency of such testing is defined by the internal procedures of the Quality Management System according to EN ISO 9001:2000 standard.

All rights are reserved to make modifications and updates to the presented data.



Product Data Sheet

Product Description	Dybond 65	
	Direct bonded magnesite chrome based on presintered magnesite chrome grain	
	SI	Imperial
Chemical Analysis (%)		
SiO ₂		1.9
Fe ₂ O ₃		9.5
Al ₂ O ₃		5.0
Cr ₂ O ₃		17.5
CaO		0.9
MgO		65.0
Physical Properties		
Apparent Porosity (%)		17.0
Bulk Density (g/ml) (lb/ft ³)	3.10	193.1
Cold Crushing Strength (MN/m ²) (lb/in ²)	50	7250
Permanent Linear Change on Reheating (%)		
2h @1700°C		0.2
Modulus of Rupture (MN/m²) (lb/in²)		
0025°C	9.0	1305
1400°C (2552°F)	5.5	798
1500°C		
Reversible Thermal Expansion (%)		
20 - 1000°C		0.9
20 - 1200°C		1.2
20 - 1400°C		1.6
Thermal Conductivity (w/mK) (BTU ft²h°F)		
Mean Temperature 500°C	2.9	20.1
Mean Temperature 700°C	2.7	18.7
Mean Temperature 900°C	2.5	17.3
Mean Temperature 1300°C	2.0	13.9

Date of Issue January 05, 2007

Version 01

The data presented are typical, and not contractual conditions of acceptance. The data presented are average values obtained by laboratory testing of production volumes. The extent and frequency of such testing is defined by the internal procedures of the Quality Management System according to EN ISO 9001:2000 standard.

All rights are reserved to make modifications and updates to the presented data.



Product Data Sheet

Product Description	Dybond 70	
	Direct bonded magnesite chrome based on presintered magnesite chrome grain	
	SI	Imperial
Chemical Analysis (%)		
SiO ₂		1.9
Fe ₂ O ₃		8.5
Al ₂ O ₃		5.0
Cr ₂ O ₃		12.0
CaO		0.9
MgO		71.0
Physical Properties		
Apparent Porosity (%)		16.8
Bulk Density (g/ml) (lb/ft ³)	3.07	191.3
Cold Crushing Strength (MN/m ²) (lb/in ²)	60	8700
Permanent Linear Change on Reheating (%)		
2h @1700°C		0.1
Modulus of Rupture (MN/m²) (lb/in²)		
0025°C	9.0	1305
1400°C (2552°F)	6.0	870
1500°C		
Reversible Thermal Expansion (%)		
20 - 1000°C		1.1
20 - 1200°C		1.4
20 - 1400°C		1.7
Thermal Conductivity (w/mK) (BTU ft²h°F)		
Mean Temperature 500°C	3.3	22.9
Mean Temperature 700°C	3.0	20.8
Mean Temperature 900°C	2.7	18.7
Mean Temperature 1300°C	2.2	15.3

Date of Issue January 05, 2007

Version 01

The data presented are typical, and not contractual conditions of acceptance. The data presented are average values obtained by laboratory testing of production volumes. The extent and frequency of such testing is defined by the internal procedures of the Quality Management System according to EN ISO 9001:2000 standard.

All rights are reserved to make modifications and updates to the presented data.



Product Data Sheet

Product	Dybond 75KF	
Description	Direct bonded magnesite chrome based on fused grain magnesia with chrome boost	
	SI	Imperial
Chemical Analysis (%)		
SiO ₂		0.6
Fe ₂ O ₃		3.8
Al ₂ O ₃		2.0
Cr ₂ O ₃		13.0
CaO		1.4
MgO		79.5
Physical Properties		
Apparent Porosity (%)		17.0
Bulk Density (g/ml) (lb/ft ³)	3.11	193
Cold Crushing Strength (MN/m ²) (lb/in ²)	40	5800
Permanent Linear Change on Reheating (%)		
2h @1700°C		0
Modulus of Rupture (MN/m²) (lb/in²)		
0025°C	12.0	1740
1400°C (2552°F)	10.5	1523
1500°C	-	-
Reversible Thermal Expansion (%)		
20 - 1000°C		1.3
20 - 1200°C		1.6
20 - 1400°C		1.9
Thermal Conductivity (w/mK) (BTU ft²h°F)		
Mean Temperature 500°C	3.6	25.0
Mean Temperature 700°C	3.3	22.9
Mean Temperature 900°C	3.0	20.8
Mean Temperature 1300°C	2.9	20.1

Date of Issue January 05, 2007

Version 01

The data presented are typical, and not contractual conditions of acceptance. The data presented are average values obtained by laboratory testing of production volumes. The extent and frequency of such testing is defined by the internal procedures of the Quality Management System according to EN ISO 9001:2000 standard.

All rights are reserved to make modifications and updates to the presented data.



Product Data Sheet

Product Description	Dybond 75KF	
	Direct bonded magnesite chrome based on fused grain magnesia with chrome boost	
	SI	Imperial
Chemical Analysis (%)		
SiO ₂		0.6
Fe ₂ O ₃		3.8
Al ₂ O ₃		2.0
Cr ₂ O ₃		13.0
CaO		1.4
MgO		79.5
Physical Properties		
Apparent Porosity (%)		17.0
Bulk Density (g/ml) (lb/ft ³)	3.11	193
Cold Crushing Strength (MN/m ²) (lb/in ²)	40	5800
Permanent Linear Change on Reheating (%)		
2h @1700°C		0
Modulus of Rupture (MN/m²) (lb/in²)		
0025°C	12.0	1740
1400°C (2552°F)	10.5	1523
1500°C	-	-
Reversible Thermal Expansion (%)		
20 - 1000°C		1.3
20 - 1200°C		1.6
20 - 1400°C		1.9
Thermal Conductivity (w/mK) (BTU ft²h°F)		
Mean Temperature 500°C	3.6	25.0
Mean Temperature 700°C	3.3	22.9
Mean Temperature 900°C	3.0	20.8
Mean Temperature 1300°C	2.9	20.1

Date of Issue January 05, 2007

Version 01

The data presented are typical, and not contractual conditions of acceptance. The data presented are average values obtained by laboratory testing of production volumes. The extent and frequency of such testing is defined by the internal procedures of the Quality Management System according to EN ISO 9001:2000 standard.

All rights are reserved to make modifications and updates to the presented data.



Product Data Sheet

Product Description	Mag chrome BXP Direct bonded magnesite chrome.	
	SI	Imperial
Chemical Analysis (%)		
SiO ₂		2.20
Fe ₂ O ₃		10.0
Al ₂ O ₃		7.5
Cr ₂ O ₃		20.5
CaO		0.80
MgO		59.0
Physical Properties		
Apparent Porosity (%)		19.0
Bulk Density (g/ml) (lb/ft ³)	3.05	190
Cold Crushing Strength (MN/m ²) (lb/in ²)	40	5800
Permanent Linear Change on Reheating (%)		
2h @1700°C		0
Modulus of Rupture (MN/m²) (lb/in²)		
0025°C	9	1450
1400°C (2552°F)	6	1160
1500°C	-	-
Reversible Thermal Expansion (%)		
20 - 1000°C		0.90
20 - 1200°C		1.20
20 - 1400°C		1.6
Thermal Conductivity (w/mK) (BTU ft²h°F)		
Mean Temperature 500°C	2.9	20.1
Mean Temperature 700°C	2.7	18.7
Mean Temperature 900°C	2.5	17.3
Mean Temperature 1300°C	2.0	13.9

Date of Issue January 05, 2007

Version 01

The data presented are typical, and not contractual conditions of acceptance. The data presented are average values obtained by laboratory testing of production volumes. The extent and frequency of such testing is defined by the internal procedures of the Quality Management System according to EN ISO 9001:2000 standard.

All rights are reserved to make modifications and updates to the presented data.



Product Data Sheet

Product Description	Basex AXP	
	Direct bonded chrome magnesite	
	SI	Imperial
Chemical Analysis (%)		
SiO ₂		2.30
Fe ₂ O ₃		11.0
Al ₂ O ₃		9.0
Cr ₂ O ₃		24.0
CaO		0.7
MgO		53.0
Physical Properties		
Apparent Porosity (%)		19.5
Bulk Density (g/ml) (lb/ft ³)	3.09	192.5
Cold Crushing Strength (MN/m ²) (lb/in ²)	35	5075
Permanent Linear Change on Reheating (%)		
2h @1700°C		0
Modulus of Rupture (MN/m²) (lb/in²)		
0025°C	10.0	1450
1400°C (2552°F)	7.0	1015
1500°C	-	-
Reversible Thermal Expansion (%)		
20 - 1000°C		0.80
20 - 1200°C		1.00
20 - 1400°C		1.3
Thermal Conductivity (w/mK) (BTU ft²h°F)		
Mean Temperature 500°C	2.2	15.2
Mean Temperature 700°C	2.1	14.6
Mean Temperature 900°C	2.0	13.9
Mean Temperature 1300°C	1.8	12.5

Date of Issue January 05, 2007

Version 01

The data presented are typical, and not contractual conditions of acceptance. The data presented are average values obtained by laboratory testing of production volumes. The extent and frequency of such testing is defined by the internal procedures of the Quality Management System according to EN ISO 9001:2000 standard.

All rights are reserved to make modifications and updates to the presented data.



Product Data Sheet

Product	Topkrom MCV
Product Base	Fused magnesia chrome grain
Application	Non ferrous, Tuyeres, Flash Smelter, RH and DH degasser
Chemical Analysis (%)	
SiO ₂	1.1
Fe ₂ O ₃	13.1
Al ₂ O ₃	7.0
Cr ₂ O ₃	23.3
CaO	1.0
MgO	53.0
Physical Properties	
Apparent Porosity (%)	16.0
Bulk Density (g/ml)	3.29
Cold Crushing Strength (MN/m ²)	80
Reversible Thermal Expansion (%)	
20 - 300°C	0.28
20 - 1400°C	1.53
20 - 1600°C	1.7
Thermal Conductivity (w/mK)	
Mean Temperature 700°C	2.80
Mean Temperature 1000°C	2.70
Mean Temperature 1200°C	2.70

Date of Issue June 05, 2007

Version 01

The data presented are typical, and not contractual conditions of acceptance. The data presented are average values obtained by laboratory testing of production volumes. The extent and frequency of such testing is defined by the internal procedures of the Quality Management System according to EN ISO 9001:2000 standard.

All rights are reserved to make modifications and updates to the presented data.



Product Data Sheet

Product	Topkrom MCZ 21
Product Base	Fused magnesia chrome grain
Application	Non ferrous, Tuyeres, Flash Smelter, RH and DH degasser
Chemical Analysis (%)	
SiO ₂	0.90
Fe ₂ O ₃	7.00
Al ₂ O ₃	4.30
Cr ₂ O ₃	21.10
CaO	0.9
MgO	65.8
Physical Properties	
Apparent Porosity (%)	16.0
Bulk Density (g/ml)	3.22
Cold Crushing Strength (MN/m ²)	60
Reversible Thermal Expansion (%)	
20 - 300°C	0.29
20 - 1400°C	1.68
20 - 1600°C	1.80
Thermal Conductivity (w/mK)	
Mean Temperature 700°C	2.90
Mean Temperature 1000°C	2.80
Mean Temperature 1200°C	2.80

Date of Issue June 05, 2007

Version 01

The data presented are typical, and not contractual conditions of acceptance. The data presented are average values obtained by laboratory testing of production volumes. The extent and frequency of such testing is defined by the internal procedures of the Quality Management System according to EN ISO 9001:2000 standard.

All rights are reserved to make modifications and updates to the presented data.



Product Data Sheet

Product	Topkrom MCW15
Product Base	Natural magnesia and chrome ore
Application	Non ferrous, EAF, VOD, VAD and LF
Chemical Analysis (%)	
SiO ₂	1.80
Fe ₂ O ₃	9.30
Al ₂ O ₃	4.80
Cr ₂ O ₃	16.00
CaO	0.4
MgO	65.00
Physical Properties	
Apparent Porosity (%)	20.00
Bulk Density (g/ml)	3.00
Cold Crushing Strength (MN/m ²)	60
Reversible Thermal Expansion (%)	
20 - 300°C	
20 - 1400°C	
20 - 1600°C	
Thermal Conductivity (w/mK) (BTU ft²h°F)	
Mean Temperature 700°C	3.94
Mean Temperature 1000°C	2.78
Mean Temperature 1200°C	2.54

Date of Issue June 05, 2007

Version 01

The data presented are typical, and not contractual conditions of acceptance. The data presented are average values obtained by laboratory testing of production volumes. The extent and frequency of such testing is defined by the internal procedures of the Quality Management System according to EN ISO 9001:2000 standard.

All rights are reserved to make modifications and updates to the presented data.



Product Data Sheet

Product	Topkrom MCW18
Product Base	Natural magnesia and chrome ore
Application	Non ferrous, EAF, VOD, VAD and LF
Chemical Analysis (%)	
SiO ₂	1.40
Fe ₂ O ₃	8.90
Al ₂ O ₃	5.1
Cr ₂ O ₃	19.4
CaO	0.6
MgO	63.6
Physical Properties	
Apparent Porosity (%)	17.0
Bulk Density (g/ml)	3.11
Cold Crushing Strength (MN/m ²)	65
Reversible Thermal Expansion (%)	
20 - 300°C	0.32
20 - 1400°C	1.48
20 - 1600°C	1.63
Thermal Conductivity (w/mK)	
Mean Temperature 700°C	3.87
Mean Temperature 1000°C	2.58
Mean Temperature 1200°C	2.62

Date of Issue June 05, 2007

Version 01

The data presented are typical, and not contractual conditions of acceptance. The data presented are average values obtained by laboratory testing of production volumes. The extent and frequency of such testing is defined by the internal procedures of the Quality Management System according to EN ISO 9001:2000 standard.

All rights are reserved to make modifications and updates to the presented data.



Product Data Sheet

Product	Topkrom MCW22/K
Product Base	Natural magnesia and chrome ore
Application	Non ferrous, EAF, VOD, VAD and LF
Chemical Analysis (%)	
SiO ₂	1.30
Fe ₂ O ₃	11.10
Al ₂ O ₃	6.40
Cr ₂ O ₃	23.10
CaO	0.7
MgO	57.50
Physical Properties	
Apparent Porosity (%)	17.00
Bulk Density (g/ml)	3.15
Cold Crushing Strength (MN/m ²)	60
Modulus of Rupture (MN/m²)	
20°C	7.5
1450°C	4.3
Reversible Thermal Expansion (%)	
20 - 300°C	0.32
20 - 1400°C	1.73
20 - 1600°C	2.00
Thermal Conductivity (w/mK)	
Mean Temperature 700°C	3.94
Mean Temperature 1000°C	2.78
Mean Temperature 1200°C	2.54

Date of Issue June 05, 2007

Version 01

The data presented are typical, and not contractual conditions of acceptance. The data presented are average values obtained by laboratory testing of production volumes. The extent and frequency of such testing is defined by the internal procedures of the Quality Management System according to EN ISO 9001:2000 standard.

All rights are reserved to make modifications and updates to the presented data.



Product Data Sheet

Product	Bondmix ZMCF
Product Base	Magnesia chrome mortar with chemical binders
Application	Jointing of magnesia chrome bricks
Chemical Analysis (%)	
SiO ₂	3.60
Fe ₂ O ₃	8.20
Al ₂ O ₃	3.90
Cr ₂ O ₃	9.50
CaO	1.00
MgO	70.50
Grain Size (mm)	0 – 0.1
Water Addition (%)	12
Use	Use within 1.5 hours of mixing

Date of Issue June 05, 2007

Version 01

The data presented are typical, and not contractual conditions of acceptance. The data presented are average values obtained by laboratory testing of production volumes. The extent and frequency of such testing is defined by the internal procedures of the Quality Management System according to EN ISO 9001:2000 standard.

All rights are reserved to make modifications and updates to the presented data.



Product Data Sheet

Product Description	Konmix MKX2L Ramming/casting magnesite chrome mix
Product Base	Fused magnesia chrome grain
Application	Sealing in walls and bottoms of thermal vessels
Chemical Analysis (%)	
SiO ₂	3.6
Fe ₂ O ₃	10.9
Al ₂ O ₃	6.4
Cr ₂ O ₃	24.0
CaO	0.9
MgO	52.5
Physical Properties After firing 1680 (°C)	
Apparent Porosity (%)	18.5
Bulk Density (g/ml)	3.05
Cold Crushing Strength (MN/m ²)	40
Cold Crushing Strength (MN/m ²) Dried (110°C)	60
Grain Size	0 – 4 mm
Particle Size Distribution (%)	
<0.063 mm	32
>4 mm	3
Water content for casting (%)	5.5 – 6.5
Water content for ramming (%)	3.5 – 4.5

Date of Issue June 05, 2007

Version 01

The data presented are typical, and not contractual conditions of acceptance. The data presented are average values obtained by laboratory testing of production volumes. The extent and frequency of such testing is defined by the internal procedures of the Quality Management System according to EN ISO 9001:2000 standard.

All rights are reserved to make modifications and updates to the presented data.