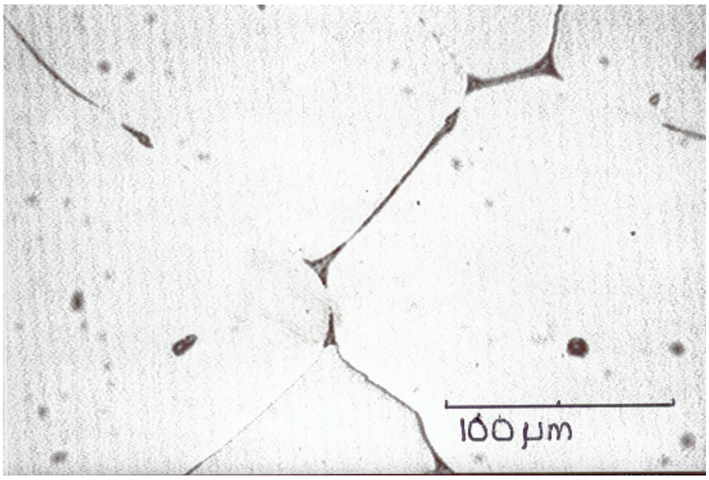
UNIQUE LARGE CRYSTAL SINTERMAGNESIA FROM PREMIER PERICLASE

Premier Periclase produces the worlds only Large Crystal Seawater Sintermagnesia. The unique properties of the Large Crystal MgO grains, combined with the chemical purity and consistency of a synthetic seawater magnesia, are particularly suited for use in all types of Magnesia Carbon refractories, for the most severe wear areas of Steel Converters, Electric Arc Furnaces, Ladles and other steel making applications.



Premier LC Sinter, Average Crystal Size 140µm

Refractory Wear Mechanisms in Steel Making

Magnesia carbon linings are attacked by Mechanical, Chemical and Thermal wear mechanisms that can operate separately or in combination. Principal among these are:

- Mechanical Erosion of MgO grain by Slag Penetration
- High temperature softening of the silicate bond between MgO grains
- Chemical Reduction of MgO by Carbon at high temperature
- Chemical Oxidation of Carbon resulting in exposure and loss of MgO

To combat these wear mechanisms, the refractory brick must combine the most suitable raw materials, especially sinter magnesia, with the best manufacturing technology, brick design and formulation.

Large Crystal Size Reduces the Effects of Wear Mechanisms

When the hot-face zone of refractories is exposed to service conditions, magnesia can be altered by the interaction of infiltrating slags, which impairs the integrity of the refractory and can make the magnesia more susceptible to dissociation, corrosion, and erosion. Premier Periclase Large Crystal Sintermagnesia with *fewer* grain boundaries, high bulk density and low porosity inhibits the ingress of corrosive slag preventing the "wash-out" of the MgO grains.

A further effect of slag penetration is the that the hot slag can cause crystal growth in the MgO giving rise to stress within the magnesia leading to a further breakdown in the integrity of the refractory. Large Crystal Magnesia having undergone high temperature sintering at +2,200 deg. C is *not* affected by this crystal growth wear mechanism.

Large Crystal Sintermagnesia also provides protection to the reduction of the MgO grains by Carbon at high temperatures because the larger crystals exhibit lower surface area and consequently have a lower reactivity to Carbon attack.

Premier Periclase Sintermagnesia – Balanced Chemistry

	Typical
MgO	**97.2%**
CaO	**2.1%**
SiO_2	**0.20%**
B_2O_3	**0.01%**
Fe_2O_3	**< 0.2%**
Al_2O_3	**< 0.05%**
C/S Ratio	**> 7**
Bulk Density	**3.42**
Crystal Size	**140 micron**

PREMIER PERICLASE HIGH C/S RATIO

Pure MgO is extremely refractory, having a melting point of 2,800 deg. C. However, the amounts, types, and mineral forms of the impurities can produce combinations, which form liquids at much lower temperatures, compromising the refractoriness of MgO.

CaO and SiO_2 are two of the most important impurities and usually the most abundant. The ratio of CaO and SiO_2, abbreviated as C/S, plays a major role in determining the refractoriness and mineralogical composition of magnesia.

In magnesia grains, CaO combines with SiO_2 to form silicate compounds. The type of silicate is determined by the C/S ratio. Dicalcium silicate ($2CaO.SiO_2$) and tricalcium silicate ($3CaO.SiO_2$) are the most desirable silicate for magnesia grains used in refractory brick service linings.

At a high C/S ratios (5 or above), dicalcium silicate and tricalcium silicate are formed. Both these compounds have high melting points, 2130 deg. C, and do not form any low eutectic melting-point compound with MgO. Hence, the refractoriness of MgO is affected very little by dicalcium or tricalcium silicate.

However, as the C/S ratio drops, the silicate phase changes to merwinite ($3CaO.MgO.2SiO_2$), and then to monticellite ($CaO.MgO.SiO_2$). Merwinite and monticellite, alone or in combination, are low melting point silicates (1480 deg. C), which adversely affect the refractoriness of the magnesia grains.

Premier Periclase Large Crystal Sintermagnesia with high C/S ratio (typically +7) forms high melting point di- and tri-calcium silicates ensuring the refractoriness of the MgO grains remains unaffected.

PREMIER PERICLASE LOW BORON

Refractory brick made from magnesia with high C/S ratios, exhibits very high strengths at elevated temperatures in the hot modulus of rupture test. However, even seemingly minor amounts of B_2O_3 by reacting with the Calcium Silicate phases can form low melting point compounds, which have a detrimental effect on hot strength. The formation of these Boron compounds leads to a "softening" of the calcium silicate bonds and gives rise to higher abrasion in the refractory. To maintain high hot strength, B_2O_3 content in Magnesia therefore should be less than 0.03%. Premier Periclase Large Crystal Sintermagnesia has very low B_2O_3 content, at 0.01% ensuring the Di- and tri-calcium silicate bonds are not compromised.

PREMIER PERICLASE LOW IRON and LOW ALUMINA

Al_2O_3 and Fe_2O_3 can combine with MgO to form Magnesium Aluminate ($MgO.Al_2O_3$) or Magnesioferrite ($MgO.Fe_2O_3$). These minerals are members of the spinel family of minerals. At very low levels, these two spinels are usually completely contained with MgO in *periclase* solid solution. However, as the amount of Al_2O_3 and/or Fe_2O_3 increases, a point is reached where some of the spinel dissolves in the low-melting silicates (merwinite and monticellite), which adds to the volume of liquid formed at high temperatures in magnesia and reduces its refractoriness.

A further detrimental effect of a high Fe_2O_3 content is that it is readily reduced to metallic Iron (Fe) in the presence of Carbon (also present in the refractory brick). The formation of metallic Iron leads to oxidation and depletion of carbon from the MgO brick, thereby

The oxidation of carbon in the hot-face zone of carbon containing MgO brick weakens the structure of the brick and increases porosity. Thus, the amounts of Fe_2O_3 and Al_2O_3 impurities need to be kept low.

In Premier Periclase Sintermagnesia the high C/S ratio ensures the extremely low Al_2O_3 (<0.05%) and Fe_2O_3 (<0.20%) levels are *dissolved* in the CaO preventing the formation of low melting point $MgO.Al_2O_3.Fe_2O_3$ spinels.