# Cordierite Kiln Furniture

## Typical Properties

| CAST MATERIALS | | CSM<br>Standard quality<br>Cast saggars | CSE<br>Enhanced quality | CFE<br>Thermal shock resistant |
|---|---|---|---|---|
| **Composition** | | | | |
| $Al_2O_3$ | % | 43 | 38 | 44 |
| $SiO_2$ | % | 47 | 51 | 44 |
| MgO | % | 7 | 8 | 10 |
| **Property** | | | | |
| Max Service Temperature | °C (°F) | 1200 (2200) | 1250 (2300) | 1250 (2300) |
| Bulk Density | $g/cm^3$ | 2.0 | 1.9 | 1.8 |
| Open Porosity | % | 24 | 29 | 32 |
| Modulus of Rupture (room temp) | MPa | 12 | 30 | 16 |
| Modulus of Rupture (1250°C) | GPa | 13 | 25 | 15 |
| Thermal Expansion (20-1000°C) | $x10^{-6}/K$ | 2.4 | 2.6 | 1.8 |
| Specific Heat | (kJ/kg.K) | 1 | 1 | 1 |

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## General Guidance

IPS kiln furniture materials are often called 'cordierite', but a more accurate description would be 'cordierite/mullite' as the material is a mixture of both minerals. There is also a small amount of silica glass that forms a glassy-bond between the larger grains, and sometimes small amounts of corundum and/or zircon. Cordierite kiln furniture is the material of choice for firing and heat-treatment processes below 1300°C due to the unique blend of properties:-

- **Thermal Cracking** – the low thermal expansion of cordierite (which minimises thermal stresses), combined with a coarse grog microstructure (that impedes crack growth), helps to minimise the risk of cracking when repeatedly thermally cycled, or when rapidly heated or cooled.
- **Compatibility** – our materials do not react with clay-based ceramics such as earthenware or other pottery bodies. A coating of batt-wash can be applied to kiln furniture to prevent sticking of very vitreous bodies or to protect from glaze deposits.
- **Kiln atmospheres** - cordierite materials are stable in oxidising and slightly reducing atmospheres and can also be used in vacuum furnaces. They are not recommended for use in hydrogen rich atmospheres firing above 1200°C due to the risk of reduction of the silica component.
- **Long life** - because our materials are a blend of minerals and each mineral has a different melting point, the bulk material has a 'melting-range' rather than a melting point. Below 1100°C very little creep (hot-bending) takes place and cordierite kiln furniture can have a service life of over 10 years. Above 1100°C, the 'glassy-bond' between the larger mullite grains starts to soften and items will start to slowly bend after many firings, but good service life can still be achieved at temperatures up to 1300°C with careful design.

| | |
|---|---|
| **CSM** | Our standard cast material for batts; a great balance between cost and performance. The coarser grain-size of this material makes it most suitable for saggars and other thick-wall designs. |
| **CSE** | A 'cleaner' material with a smooth surface finish; often used for profile setters firing bone china or other vitreous bodies. |
| **CFE** | Improved thermal shock resistance; often used for large profile setters where cracking has previously been a problem. |

Kiln furniture products can absorb water during their manufacture, transportation, or storage. Wet products may crack if exposed to temperatures of more than 100°C (210°F) as the absorbed water will create uneven rates of heating across the product. Due to this: -

**ALL KILN FURNITURE PRODUCTS MUST BE DRIED BEFORE USE.**