User Guide for Cordierite-Mullite Kiln Furniture

1. Introduction

"Kiln Furniture" refers to a wide range of refactory products used to support and protect products during high-temperature processes. Used traditionally in the firing of tableware, sanitaryware, and heavy-clay products, it is employed extensively througout the ceramics industry and beyond, into applications such as powder metallurgy, glass, composites, and even bread & pizza ovens.

Cordierite and Mullite are ceramic minerals formed at high temperature by the reaction of silica, alumina and magnesia. Cordierite has a low thermal expansion, which minimizes the risk of thermal-shock during rapid heating and cooling. Mullite has good strength at high temperatures, which imparts resistance to bending and breaking under load. Cordierite-Mullite refactories are formulated to optimize the balance of these properties to suit different heat-treatment applications.

Most Cordierite-Mullite kiln furniture is stable at temperatures of up to 1350°C (2460°F), although practically its load-bearing capability (and therefore its useful life) starts to become dimished beyond 1300°C (2370°F). At higher temperatures, IPS can supply materials such as Silicon Carbide or Alumina, which are more suitable.

Kiln Furniture ("KF") is often described as either "primary" or "secondary". Primary KF is the group of products that forms the superstructure of the kiln or the kiln cars. Generally, primary KF remains in position in the kiln or on the car throughout its life. Batts, props and kiln lining systems are examples of this type of kiln furniture. Secondary KF refers to the refactories that are used to directly support products during the firing/sintering process. Each is designed to be used with a limited range of products, and is usually removed from the kiln or furnace at the end of the process. This range of KF includes items such as plate setters, cranks and sanitaryware supports.

This User Guide is intended to support you in getting the best from your kiln furniture by helping you to understand the properties and some of the typical problems encountered in each of the main product groups, and by making recommendations on the best way to use kiln furniture to maximize performance, prevent premature failure and improve longevity.

2. Choosing the Best Products for Your Application

IPS Ceramics sells tens of thousands of different shapes and sizes of kiln furniture items into a wide range of applications, and selecting exactly the right option for your process can be quite challenging. Performance of identical products can vary significantly between ostensibly similar processes, and even the conditions in different areas of the same kiln can vary sufficiently that kiln furniture can last longer at the bottom than the top of a kiln car, for example.

The extreme stresses placed on kiln furniture in normal use means that it's impossble to build-in complete resistance to every failure mode, and so choosing the most suitable product usually involves the best compromise of the most desirable properties:

- Resistance to bending
- Resistance to thermal-shock
- Strength
- Dimensional accuracy
- Cost

IPS's products have been developed and refined over many decades, and we have a range of materials and processes that are tailored to suit different requirements. The factors affecting these choices as they apply to each product range are covered in the following sections of this guide. However, for any product it is necessary to establish:

- Type of kiln or furnace
- Maximum temperature of the kiln
- Cycle time (heating, dwell & cooling)
- Atmosphere (oxidizing, reducing, glaze volatiles, etc)
- Weight and distribution of products in the kiln
- Handling methods, stability of the load, etc.

With this information, IPS Ceramics can offer you the best advice about the most appropriate products for your application. It's worth bearing in mind that the type of system you've been using for several years was probably the best available several years ago, and continuous improvement in design and materials means that a different method might be better for you now.