Thermic Edge Ltd are the sole manufacturers of SiC\textsuperscript{3}, short for cubic silicon carbide. The process is unique as it combines a well defined crystal size, isotropic structure and low surface roughness. The high growth rates achieved by SiC\textsuperscript{3} ensures that the product remains cost effective. Layer thickness can be varied but typically a layer of 80 – 100µm is achieved.

Vacuum Heating Technology

Our Revolutionary SiC\textsuperscript{3} Coating Offers Great Advantages:

- **Cubic structure giving high density coating**
  This vastly improves corrosion resistance and increases the component's life.

- **Excellent coverage down blind holes**
  With 30% coating thickness down a Ø1x5mm deep hole.

- **High Thickness Uniformity**
  SiC coating offers high coating thickness uniformity of +/-10microns on 100micron thick coating. We are working on improving this uniformity further to +/-5 microns, in the near future.

- **High purity coating**
  Is achievable by using high purity gases in the coating process, while also remaining low in N2 absorption to achieve higher than industry standard purity. We also offer a version of the coating with no Nitrogen.

- **Adjustable surface roughness**
  The coating process can be tailored to give different surface roughnesses.

- **Fast delivery**
  Thermic Edge Ltd will ship with a short lead time. Typically 6 weeks.

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The coating can be used in semiconductor, aerospace and heating technologies. It will provide a high purity and impervious layer on graphite, porous ceramics and composites. The combination of graphite selection and graphite machining expertise, developed by Thermic Edge, will ensure that customers experience optimal support for various critical components within these industries.
Surface roughness
A typical surface roughness profile is shown here.

The surface roughness parameters are $R_a = 0.8 \, \mu m$, $R_z = 5 \, \mu m$ and $R_t = 8 \, \mu m$.

**XRD**
An XRD diagram is shown here, on the left. The peaks shown in the diagram perfectly match the 3C crystal structure. Based on measurements from 80 $\mu m$ thick coating.

**General Properties**
Listed here are the typical values for some of the important properties for SiC$^3$. Some of these (i.e. crystal size, electrical resistivity) can be customised and optimised for specific applications.
**SiC³ Ceramic Coating**

SiC³, short for cubic silicon carbide, is the isotropic, pure silicon carbide coating manufactured by Thermic Edge for a wide range of applications. High temperature resistant materials such as graphite, SiC-based ceramics and some refractory metals such as tungsten and molybdenum can be coated in SiC³. The coating protects the underlying material against corrosion, oxidation, acts as a diffusion barrier and prevents absorption and desorption of impurities from the underlying material which can interfere with your processes. The coating also prevents particles from the underlying material interfering with the process or device to be made in the process. In combination with porous materials such as graphite, the upper layer of graphite is infiltrated with SiC³ coating, resulting in ultimate adhesion and corrosion protection. Applications can be found in the semi-conductor industry, LED manufacturing, solar, special heat treatment and aerospace.

**Thermic Edge Coatings**

As an independent coating supplier, Thermic Edge works closely together with local suppliers of graphite and SiC ceramic components to offer short delivery times, competitive cost and the highest quality standards. The coating produced has a preferential cubic, 3C structure which gives the best corrosion protection when compared to other SiC structures. Not restricted to specific graphite qualities or other material grades we can provide bespoke solutions for bespoke problems.
Technology and general characteristics
Thermic Edge uses CVD technology to manufacture thin SiC\textsuperscript{3} layers between 10 and 200 µm. The coating produced has a preferential cubic, 3C structure which gives the best corrosion protection when compared to other SiC structures. Standard thickness is 80 – 100 µm and the technology allows to cover all areas with a dense coating. Small, blind holes are coated even for holes with a 1 mm diameter and over 5 mm depth.

Products are placed in the Thermic Edge in-house reactor on pure materials compatible to the process such as high purity graphite components and pre-coated SiC\textsuperscript{3} support materials. Combined with the use of semiconductor grade gases, it leads to a coating with minimum impurity levels and therefore improved corrosion resistance (Material Purity, see page 4). The design of the reactor ensures only highly pure materials are present in the high temperature zone, along with high purity gases which results in extremely pure layers with a high electrical resistivity. High temperature processes at end customers, have proven the outstanding quality of the SiC\textsuperscript{3} coating, often outperforming OEM based solutions.

Wafers (silicon, sapphire, SiC, GaN) treated will benefit from the high purity and well defined SiC\textsuperscript{3} interface. Thermal conductivity is high and thermal transfer is not limited through the coating. Other material properties conform with theoretical values (see SiC\textsuperscript{3} specification, page 1).

Thermic Edge is committed to further investments and scaling up of it’s process, and in the near future will be able to coat larger sized parts. At the moment the maximum sized part is restricted to Ø 360mm.

<table>
<thead>
<tr>
<th>Element</th>
<th>Impurities (PPM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Magnesium</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Aluminium</td>
<td>&lt; 0.02</td>
</tr>
<tr>
<td>Potassium</td>
<td>&lt; 0.5*</td>
</tr>
<tr>
<td>Calcium</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>Titanium</td>
<td>&lt; 0.005</td>
</tr>
<tr>
<td>Vanadium</td>
<td>&lt; 0.005</td>
</tr>
<tr>
<td>Chromium</td>
<td>&lt; 0.3</td>
</tr>
<tr>
<td>Iron</td>
<td>&lt; 0.04</td>
</tr>
<tr>
<td>Cobolt</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>Nickel</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>Molybdenum</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>Tin</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>Tungsten</td>
<td>&lt; 0.01</td>
</tr>
</tbody>
</table>

* Lowest Limit of Detection With This Method.

Material Purity
This table shows the impurities in SiC\textsuperscript{3} coating.

Testing carried out by EAG Laboratories using Glow Discharge Mass Spectroscopy.
Quartztec Europe, based in East Kilbride, Scotland, is the exclusive sales outlet for Thermic Edge’s non-heaters products and provides us with a wealth of experience in industries, including LED and Semiconductor.

Quartztec Europe is one of Europe’s leading quartz fabricators and have been manufacturing product for industries including Semiconductor, Solar, Optical and LED for over 25 years.

Elements
The following diverse selection of heaters have been used by customers worldwide for heating in O2 environments. A range of standard element sizes are available from stock.

Applications
The gallery below shows SiC³ coated products used in semiconductor, LED and mechanical applications.

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