EQ Coating
for Next Generation TBC and Environmental Coating Systems
National Institute for Materials Science, Tsukuba, Japan

New Bond Coat System, “EQ coating”

Concept
Equilibrium (thermodynamic) with the substrate = EQ Coating

Objective
To develop new bond coat systems that hinder interdiffusion with the substrate of Ni-base single crystal superalloy, so the formation of detrimental SRZ can be minimized.

The microstructure of $\alpha' + \gamma'$ in Ni-base superalloys.

Compositions of EQ bond coat are designed along the tie-line of the substrate to achieve thermodynamic equilibrium.

New EB-PVD Apparatus, “EB Coater-CerM1”

Apparatus Specification

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
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<tbody>
<tr>
<td>EB Power</td>
<td>16kW 1 Gun</td>
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<tr>
<td>Substrate Temp.</td>
<td>Max. 1100 $^\circ$</td>
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<td>Substrate Size</td>
<td>Max. □ 200mm, L350mm</td>
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<tr>
<td>Substrate Weight</td>
<td>Max. 10kg</td>
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<td>Atmosphere</td>
<td>Vacuum, Oxygen, Inert Gas</td>
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<td>Coating Rate</td>
<td>100 $\mu$m/HR</td>
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<tr>
<td>Ingot Size</td>
<td>Max. □ 50mm, L200mm</td>
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Features of Apparatus
- Inner Carbon Heater with 30kW, 3 Sets
- Precise Control of High Substrate Temp.
- Divided Crucible
  - Inner Crucible : Up and Down Moving Rotation
- Flexibility in Ingot Shape and Size
- Controllable Shutter
  - Control of Deposition Structure

YSZ Formation on EQ Coating

Coating Conditions
- Pre-oxidation: 0.2Pa O$_2$, 1072 $^\circ$, 1Hr
- Substrate Temp.: 1007 $^\circ$

Fig. Schematic diagram of the coating chamber

Fig. Surface of 7YSZ

Fig. Vertical sectional microstructure of TBC