

# Bond Coat Layers for Multilayer Thermal / Environmental Barrier Coatings

Jeffrey W. Fergus, Honglong Wang, Emily Tarwater  
Auburn University  
Kyle Murphree  
Plasma Processes, Ltd.

## Introduction

### Extend Life Gas Turbine Materials

- Improved bond coat
- Stability in Ca-Mg-Al-Si-O (CMAS)

### Coating System

- Re diffusion layer
- Ir / Hf bond coat
- YSZ / pyrochlore TBC/EBC

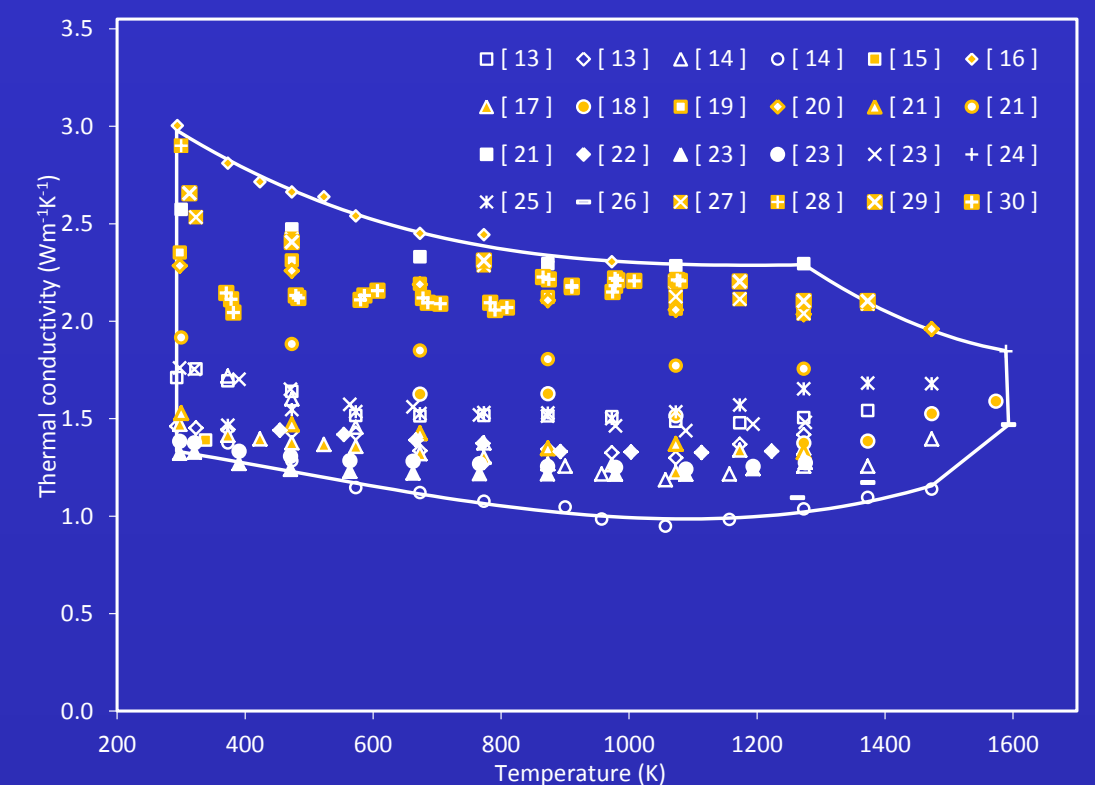
### EBC Materials

- Pyrochlore zirconates with improved stability in CMAS



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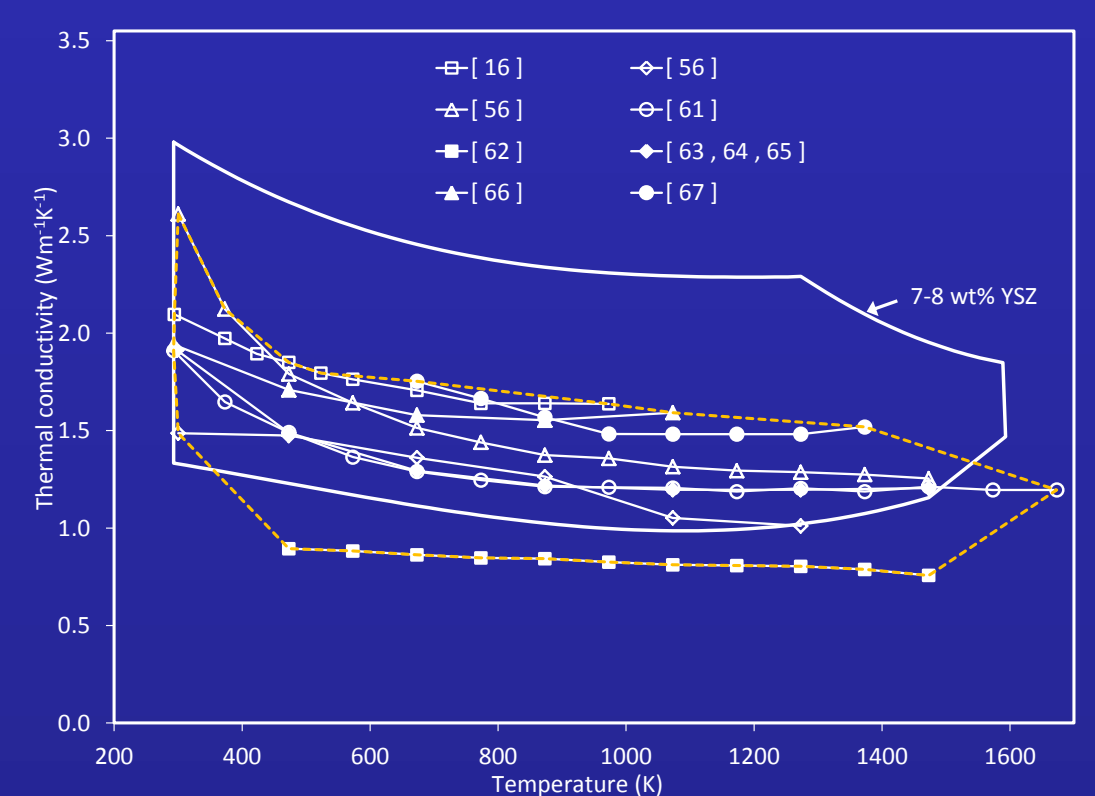
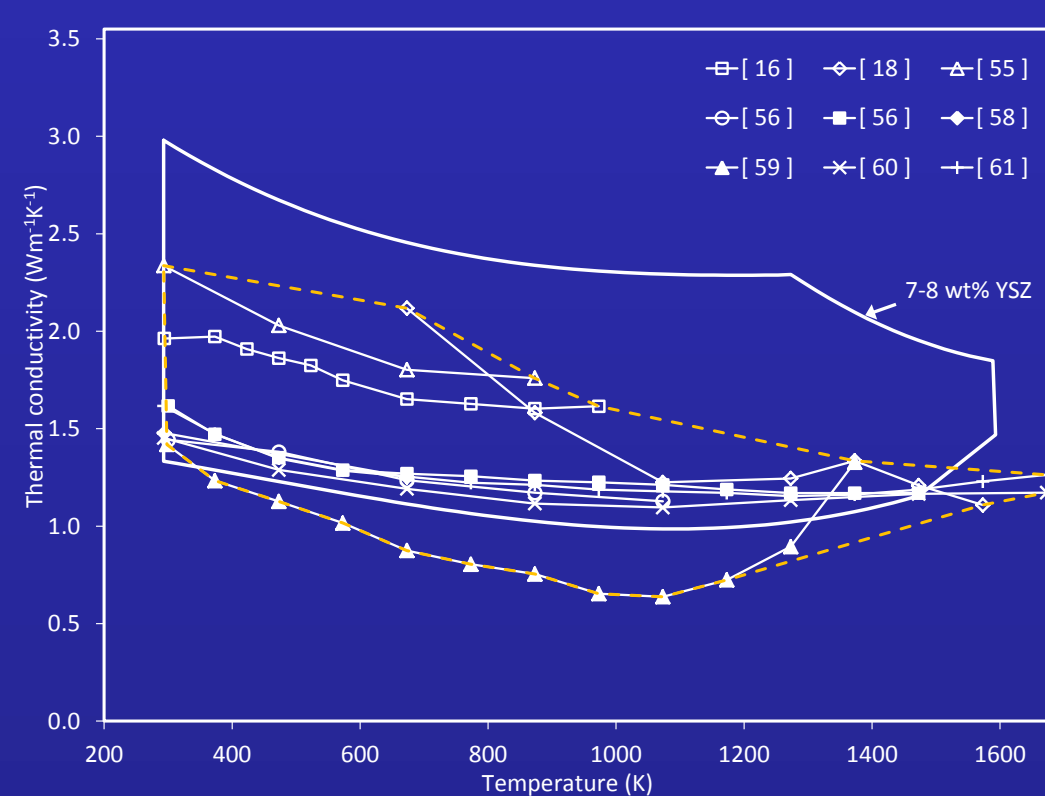
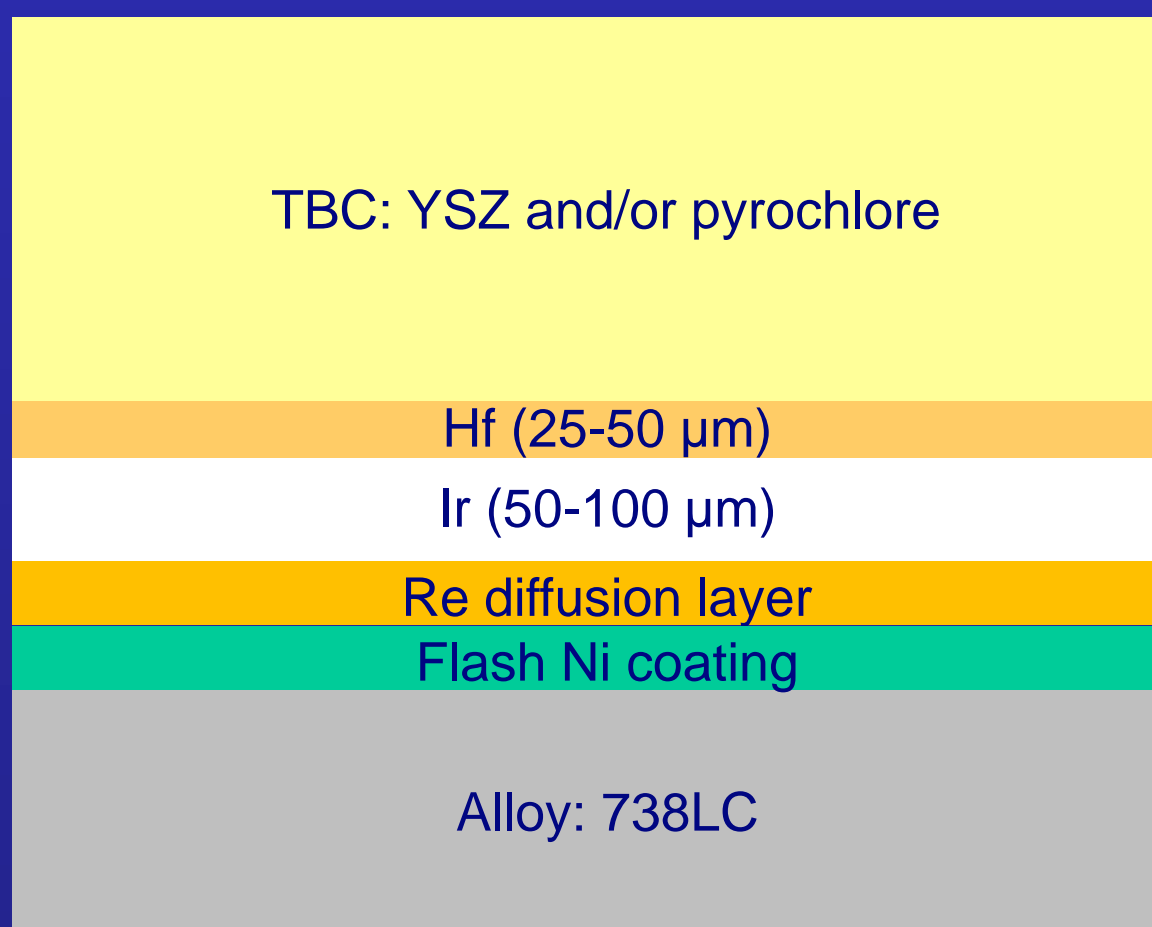
## EBC Materials



### Pyrochlore Zirconates vs YSZ

- Lower thermal conductivity
- Improved CMAS resistance

## Coating System



### Promising Pyrochlores

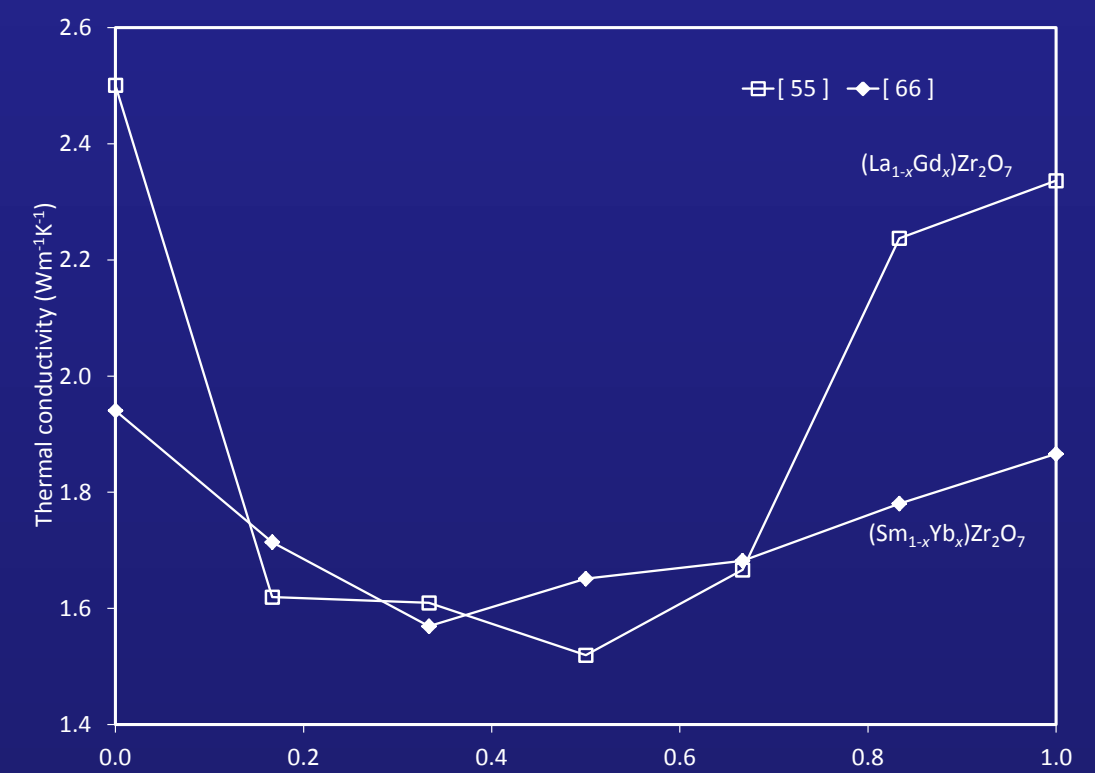
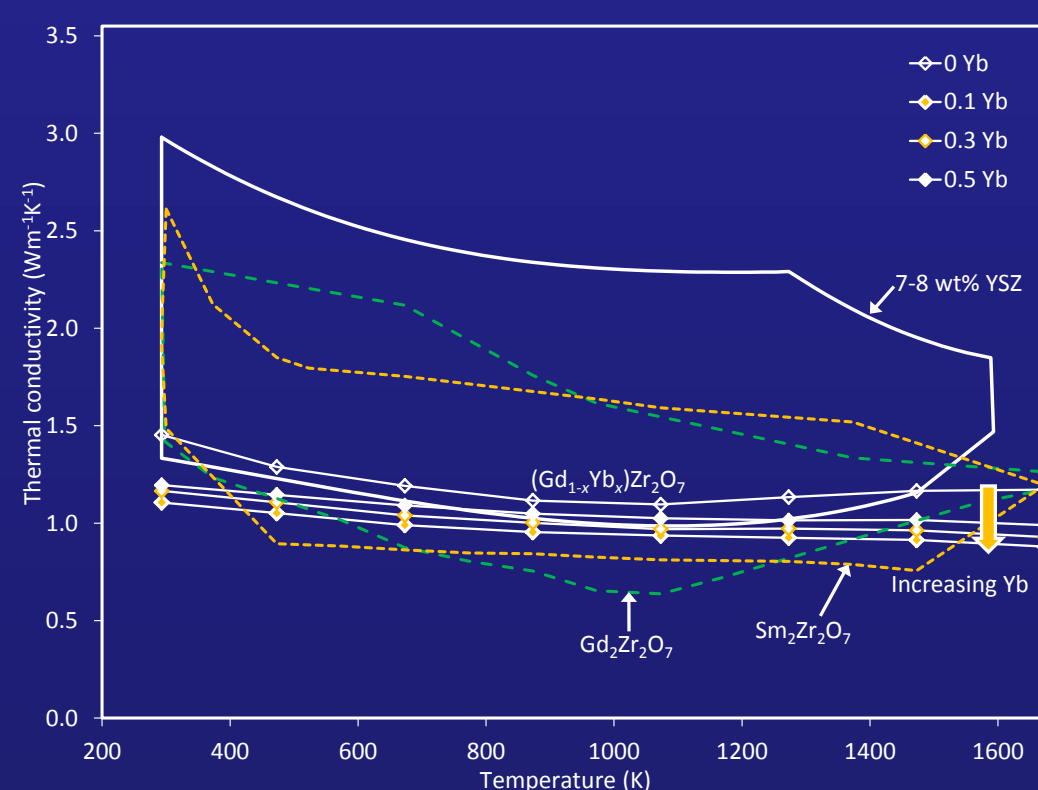
- $Gd_2Zr_2O_7$ ,  $Sm_2Zr_2O_7$
- Mixed lanthanides / doping

### Metal Coatings (Re, Ir, Hf)

- Electrodeposition in molten salt – EL-Form™
- Inert atmosphere: Oxygen-sensitive refractory materials

### Ceramic Coatings

- Very low pressure plasma spray
- Columnar microstructure



For references see J.W. Fergus, *Metall. Mater. Trans. E*, in press



Nickel layer needed

### Synthesis

- Sol-gel for phase formation
- High temperature for densification

### Evaluation

- CMAS exposure
- Accelerated tests / phase stability at high temperatures

