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## Preface

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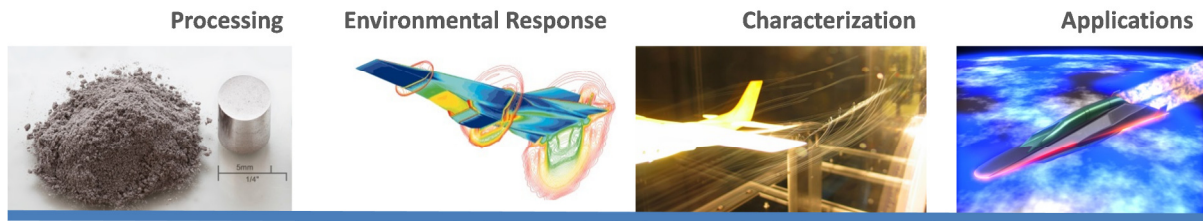
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## Ultra High Temperature Ceramics: Materials for Extreme Environment Applications III

12-16 April 2015

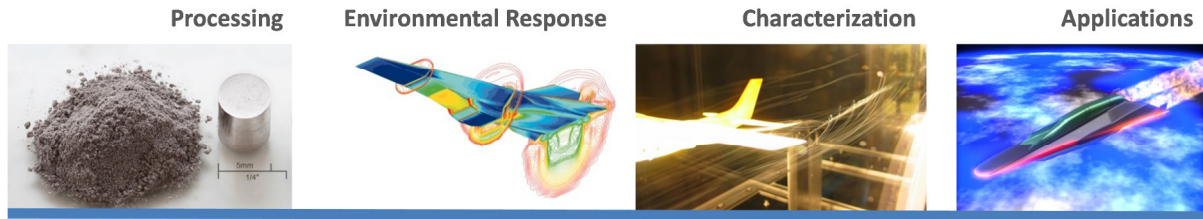
Surfers Paradise, Gold Coast, QLD (Australia)

### PREFACE

Ultra-High Temperature Ceramics are a family of compounds that display a unique set of properties, including extremely high melting temperatures ( $>3000^{\circ}\text{C}$ ), high hardness, and good chemical stability and strength at high temperatures. UHTC materials are typically considered to be the carbides, nitrides, and borides of the transition metals, but the Group IV compounds (Ti, Zr, Hf) plus TaC are generally considered to be the main focus of research due to the superior melting temperatures and stable high-melting temperature oxide that forms in situ. The combination of properties make these materials potential candidates for a variety of high-temperature structural applications, including engines, hypersonic vehicles, plasma arc electrodes, advanced nuclear fuels, fusion first walls and divertors, cutting tools, furnace elements, and high temperature shielding. The purpose of this meeting is to bring together disparate researchers from academia, government, and industry in a singular forum that allows the bench researchers to interact with designers and engineers to discuss state-of-the-art research and development efforts, what the results mean in a broader context, and how to move the technology forward toward near-term and longer term use.

While the materials of interest have been known since the 1930s, it wasn't until the seminal work sponsored by the Air Force Materials Laboratory that the class of UHTC materials became more widely known. While the advent of  $\text{SiC}$  and  $\text{Si}_3\text{N}_4$  ceramics in the early 1970s pushed interest in UHTC materials aside, recent work by NASA and others have resulted in a resurgence in R&D efforts to develop and utilize these materials for applications where the silicon-based ceramics will not survive. While small sessions on processing and oxidation studies have been held within professional societies like the American Ceramic Society (ACerS), the European Ceramic Society (ECerS), and the Electrochemical Society (ECS), there has been no overarching effort to bring





together the entire community – processing and oxidation bench scientists, designers, engineers, and users of these materials under one roof. It is difficult for the basic science community to be inclusive of the development and engineering community as it does not fall within their charters. While there have been small efforts to nucleate a leadership group within the UHTC community by AFOSR and NSF workshops on the topic, they have largely been focused on contract awardees within those communities.

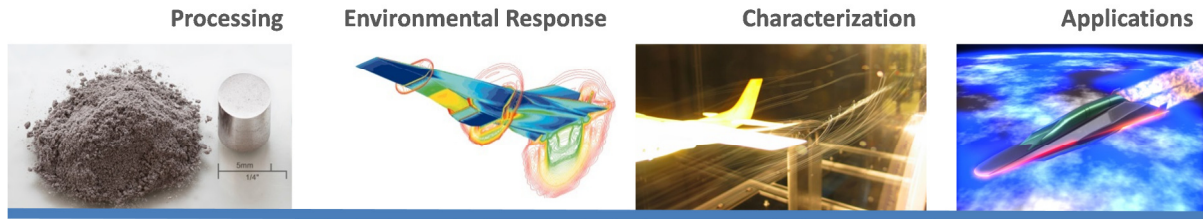
This conference is the third in this series. The previous two conferences were organized by Dr. Eric Wuchina in Lake Tahoe in 2008 and by Prof. Bill Fahrenholtz in Austria in 2012, respectively. As with the two previous conferences, the bulk of the work is focused on the processing and relevant characterization studies, as these materials are the subject of numerous fundamental research studies, but enough work is ongoing to include the testing and design communities, as well as bring in the “bigger picture” systems-level engineers and managers to introduce them to the capabilities of the materials and share with the researchers the needs of the programs can be relayed to the R&D community.

In this conference, the presentations have been divided into 6 main sessions:

1. Synthesis and Processing
2. Characterization
3. Barriers/Coatings/Porous
4. Phase Stability
5. Fibres and Composites
6. Joining.

We would like to thank our sponsors for their generous contribution towards this meeting: Defence Materials Technology Centre (DMTC) from Australia and Office of Naval Research Global (ONRG) and ITC-Army from the United States. We also would like to acknowledge the American Ceramic Society for endorsing this meeting.





We specially would like to say thanks to our dedicated Scientific Committee for their support and help organizing the speakers and topics:

- Prof. **Bill Fahrenholtz**, Missouri University S& T, Rolla, US
- Dr. **Eric Wuchina**, Naval Surface Warfare Center, US
- Prof. **Jon Binner**, Univ. Birmingham, UK
- Dr. **Laura Silvestroni**, ISTECC, Italy
- Prof. **Yanchun Zhou**, Aerospace Res. Inst. Mat., China
- Dr. **Sylvia Johnson**, NASA-Ames Research Center, US

And finally, this conference would not have been possible without the continuous encouragement, advice and support from the **ECI team**: Barbara Hickernell, Tressa D'Ottavio, Kevin Korpics, Kathy Chan and Ram Darolia.

We are really looking forward to this meeting!

Carolina Tallon and George Franks  
Conference Chairs.

