



**Materials  
Engineering  
Fall 2015  
Seminar Series**

**Friday, November 6,  
2015  
3:30 pm Coffee  
3:45 pm Seminar  
ARMS 1010**

**Professor Jing Zhang, Ph.D**

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**Microstructure Design and Performance of Lanthanum  
Zirconate Based Thermal Barrier Coatings**

Lanthanum zirconate ( $\text{La}_2\text{Zr}_2\text{O}_7$ ) is one of the proposed next generation thermal barrier coating materials due to its low thermal conductivity and superior high temperature stability. In this work, a combined experimental and computational investigation is carried out to understand structure-property relation of the material. For the experimental studies,  $\text{La}_2\text{Zr}_2\text{O}_7$  and conventional 8 wt% yttria stabilized zirconia (8YSZ) coatings were deposited using plasma spray technique. Both single-layer  $\text{La}_2\text{Zr}_2\text{O}_7$ , double-layer  $\text{La}_2\text{Zr}_2\text{O}_7/8\text{YSZ}$ , and blended  $\text{La}_2\text{Zr}_2\text{O}_7/8\text{YSZ}$  composite coating architectures were designed in the matrix for evaluation. The thermal and mechanical properties of the coatings were characterized. The results of thermal conductivity, bond strength test, erosion test, jet engine thermal shock (JETS) test, and thermal gradient mechanical fatigue (TGMF) test are presented. For the computational studies, *ab initio* calculations were conducted to compute the thermomechanical properties of  $\text{La}_2\text{Zr}_2\text{O}_7$ . Finite element simulations with realistic coating microstructures were performed to calculate the coating thermal conductivity, which are in good agreement with experimental measurements. The findings will help to propose new thermal barrier coating systems.

*Dr. Jing Zhang is Assistant Professor of Mechanical Engineering at Indian University – Purdue University Indianapolis (IUPUI). Prior to this, he was Assistant Professor of Mechanical Engineering at the University of Alaska Fairbanks (UAF) between 2005-2011. He received his B.S. in Metal Forming from University Science and Technology Beijing in 1996, and M.S. in Manufacturing Engineering from Beijing University of Aeronautics and Astronautics China in 1999. He earned his Ph.D. in Materials Science and Engineering from Drexel University in 2004. He also received postdoctoral research training in the FOCUS Center at Rensselaer Polytechnic Institute (RPI) between 2004 -2005. His main research interests include renewable energy materials, biomaterials and additive manufacturing, with a focus on structure-property relationship and processing modeling. Dr. Zhang's research has been supported by the Department of Energy, National Science Foundation, U.S. Air Force Research Laboratory, and other funding agencies.*

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