

DEPARTMENT OF MECHANICAL ENGINEERING

WILLIAM MAXWELL REED SEMINAR SERIES

Thermal Protection Systems for Space Applications: from engineering concepts to fundamentals

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Abstract: The design of the Thermal Protection System protecting a spacecraft from the heat exposure upon atmospheric entry is a very complex process relying on a collaborative process from multiple disciplines such as physics, chemistry, material science and engineering. Most high velocity entry speeds (hypersonic) use ablative (and not reusable) technology as concept for the Thermal Protection Systems. While the ultimate design is achieved using modeling tools for aerothermodynamics, heterogeneous gas-surface interactions (catalysis) and material response, these models are built and validated in ground based facilities and one of their major challenges is extrapolating the domain of application of these models to real flight conditions. The talk will describe the currently undergoing efforts in the heatshield design process to replace engineering judgment with a more methodical technique through the application of statistically derived factors of various elements of the design. It will also overview current model development efforts in the area of ablation and gas-surface interactions for hypersonic conditions (where temperatures at the surface reach more than 3000K and pressures up to 0.5 atm) including the corresponding experimental support. The information in this talk is based on the recently published AIAA paper (AIAA-2011-3757) "Defining Ablative Thermal Protection System Margins for Planetary Entry Vehicles" as well as the 4th Annual AFOSR/NASA/SNL Ablator Modeling Workshop.

Bio: Dr. Ioana Cozmuta works for STC at the NASA Advanced Supercomputing (NAS) Division, Ames Research Center. She has been at Ames for 8 years during which she has worked extensively in the field of nanotechnology and TPS design. She has a broad expertise in the field of Entry, Descent and Landing on subject areas such as TPS design and related uncertainty analysis with participation in projects including Stardust (the Post-Flight Analysis team), Orion –CEV (Margins Management Lead), MSL/MEDLI (Post flight Assessment team). Her major focus is to try to utilize scientific judgment, systematic and critical thinking as well as seamless use of both theoretical, analytical and experimental techniques in the field of engineering to approach subjects such as understanding material catalysis under extreme conditions, high-fidelity thermal ablation models, TPS design, uncertainty, risk and reliability analysis, instrumentation data to inform ground based models. In the field of surface catalysis/gas-surface interactions she is the originator of a study assessing the use of various computational chemistry techniques to look into the fundamental mechanisms underlying surface catalysis. Dr. Ioana Cozmuta received her PhD in Physics from University of Groningen, the Netherlands in 2001 followed by two postdoctoral studies at Caltech (Computational Chemistry) and Stanford (Genomics/Computational Biochemistry).

Date: November 1, 2011
Place: Room 323 RMB

Time: 3:30 pm to 4:30 pm (refreshments 3:15)
Contact: Dr. James McDonough 257-6336 x 80657

Meet the speaker and have refreshments
Attendance open to all interested persons