HARVEY MUDD COLLEGE

Engineering Seminar Program
Wednesday, April 20, 2011
Galileo McAlister 4:15 p.m.

Jay C. Hanan, Assistant Professor, Mechanical & Aerospace Engineering, Oklahoma State University

Jay Hanan has been a professor at Oklahoma State University since 2005. There he directs a graduate research team focused on Materials Science and Mechanical Engineering. He is an expert in X-ray methods and analysis of mechanical properties. His research crosses many areas including industrial polymers, amorphous metals, engineering ceramics, and their composites—often involving interesting microstructures such as foams. His team is constantly discovering new properties of materials and developing ways to test or produce them. Most projects focus on structural materials, which would find applications in anything from military armor to highway bridges or plastic bottles. For example, using a new X-ray method, they were the first to quantify residual stress in modern ceramic dental-materials. From over 100 publications, applications of recent research include several new high strength materials. The world's lightest 500 mL mass produced water bottle, the first metallic glass honeycomb, the stiffest PET nano-composite, and the lightest weight body armor are examples. His research has developed several patents and spun off two technology companies.

Before academia, Dr. Hanan worked for four years at the NASA Jet Propulsion Laboratory. There he developed technologies for applications ranging from holographic memory storage to Mars rover navigation. Some of this has now found use in automated detection of corrosion and fatigue in aircraft. He has a Ph.D. in Materials Science and Engineering from the California Institute of Technology and spent several years as a research assistant at Los Alamos National Laboratory.

Advancing Materials by Engineering Specific Strength

Materials have been improving for centuries. Historic periods are defined by the materials that dominate them; for example, the Stone Age, Bronze Age, and now a Si Age. Along with other technologies, mechanical property improvements have accelerated in the last century. These innovations have enabled man to explore space or replace damaged organs. Specific strength is one property leading such advances. To maximize it, one must go against natural property trade-offs improving mechanical properties, for example: increase failure stress while reducing density. Such materials innovations result in new or more efficient products including aircraft components or body armor, better environmental stewardship, and improved health or safety. Recent research on amorphous cellular solids and lamellar composites described here provides an example of this breaking of barriers in specific strength.