

UNH Materials Science Seminar

11:10-12:00, Thursday, April 10, 2008

Kingsbury Hall S145

University of New Hampshire

Processing of Bulk Metallic Glasses

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In contrast to most crystalline metallic materials, bulk metallic glasses (BMG) do not require post-cast processing or heat treatment and all properties are already achieved in the as-cast state. This, together with the absence of a phase transition and the sluggish crystallization kinetics opens up an opportunity for a wide range of processing methods. Fundamentally, they can be separated into two categories. BMG can be directly cast. Critical cooling rates for a wide range of BMGs are lower than 100 K/s. This however can still be challenging for the casting process since during casting cooling and filling the mold has to occur simultaneously. This limits the complexity of the geometries that can be (near) net-shaped even when processing parameters are carefully balanced. Alternatively, BMG can be superplastically formed in the supercooled liquid region where the BMG exists as a highly viscous metastable liquid. In this case the required fast cooling and forming are decoupled. The BMG is formed in a high viscous state where it behaves very similar to plastics when compared by processing temperature and forming pressure. A standard to quantify the BMG's formability will be introduced. The ability

to precisely replicate features as small as 10 nanometer can be combined with macroscopic forming into a multiscale net-shape processing method. Potentials and challenges will be discussed and various examples of the use of this processing opportunity will be given.

Jan Schroers is an associate professor in the Department of Mechanical Engineering at Yale University. He received his Ph.D in Physics from the RWTH Aachen. He spent three years with Liquidmetal Technologies as a Director of Research where he developed new processing methods based on the bulk metallic glasses thermo-plastic processability. His research interest focuses on multi-scale processing with bulk metallic glass. He studies formation, crystallization, flow behavior, and uses bulk metallic glass for nano, MEMS, and biomedical applications. He is author or co-author of over 55 publications and 9 patents. Schroers can be reached at jan.schroers@yale.edu

Host: Professor Brad Kinsey