MM 67: Mechanical Properties I

Time: Thursday 15:45–16:45 Location: IFW D

MM 67.1 Thu 15:45 IFW D

On the effects of precipitates during cyclic deformation of AA6016 alloy — •Haichun Jiang, Stefanie Sandlöbes, and Sandra Korte-Kerzel — RWTH Aachen University, Aachen, Germany

Fatigue is one of the major failure modes of structural materials. While the effects of strengthening precipitates on the mechanical properties of heat treatable aluminum alloys during forming operations are well-studied, only little is known about the related mechanisms during fatigue. We study the influence of precipitates during low cycle fatigue of an Al-Si-Mg alloy by mechanical testing and microstructure characterisation using electron backscatter diffraction and scanning transmission electron microscopy (STEM). Under-aged, peak-aged and over-aged precipitation states are studied. The experiments reveal a significant influence of the precipitate state on both, the mechanical properties and the formed dislocation structures.

MM 67.2 Thu 16:00 IFW D

Surface Roughness and Deformation Avalanches — •Adam Hinkle and Lars Pastewka — Institute for Applied Materials, Karlsruhe Institute of Technology, Karlsruhe, Germany

Most natural and man-made surfaces appear to be rough on many scales. However, there is presently no unifying theory of the origin of surface roughness. One likely contributor to the formation of roughness is the process of mechanical deformation. In particular, the plasticity observed in mechanically driven amorphous solids has been characterized by avalanches of irreversible rearrangements exhibiting a self-affine, power-law behavior. Here we show preliminary results of molecular dynamics studies of metallic glasses under bi-axial compression and the resulting roughness of the free surfaces. In particular, we connect the self-affine nature of the surface roughness appearing in the power spectral density to the avalanche behavior of the deforming system.

MM 67.3 Thu 16:15 IFW D

Development and characterization of tungsten multi-fiber reinforced tungsten composites produced by field assisted sintering technology — •Yiran Mao[1], Jan Coenen[1], Johann Riesch[3], Sree Sistla[2], Bruno Jasper[1], Alexis Terra[1], Christian Linsmeier[1], and Christoph Broeckmann[2] — [1]Institut für Energie und Klimaforschung Plasmaphysik, Forschungszentrum Jülich GmbH, 52425 Jülich — [2]Institut für Werkstoffanwendungen im Maschinenbau (IWM), RWTH Aachen University, 52062 Aachen — [3]Max-Planck-Institut für Plasmaphysik, 85748 Garching b. München

In future fusion reactors, tungsten is a main candidate material for the first wall and the divertor. The intrinsic brittleness of tungsten is, however, a concern with respect to the fusion environment. To overcome this drawback, tungsten fiber reinforced tungsten (Wf/W) composites are being developed relying on an extrinsic toughing principle. Recent progress on multi-fiber Wf/W produced by field assisted sintering technology will be presented. Preliminary mechanical tests have been performed in the as-fabricated condition. A pre-notched 3-point bending test (at RT) has been chosen to observe the fracture behavior of the Wf/W. With the optimization of the interface between the fiber and matrix, the possibility to realize the pseudo ductility mechanism has been observed based on the test results. The flexural strength and tensile strength of the Wf/W have been measured by a 4-point bending test and a tensile test, respectively. The Wf/W composites with various fiber volume fractions (from 20% to 60%) have been produced and characterized, both microstructurally and mechanically.

MM 67.4 Thu 16:30 IFW D

Nanotribology and deformation behavior of gradually crystallized Fe-based metallic glasses — •Jazmin Duarte Correa, Steffen Brinckmann, and Gerhard Dehm — Max-Planck-Institut für Eisenforschung GmbH, Düsseldorf, Germany

Although metallic glasses are acknowledged for their superior mechanical, physical and chemical properties, they are seldom used due to the limitations imposed by the required fast cooling rates to produce large volumes of material, and by their thermal stability. A window of opportunity is the use of these alloys at small length scales, e.g. gears for micromotors, or in wear and corrosion protective coatings.

In particular, Fe-based amorphous materials have been already proposed for both applications since they exhibit remarkable mechanical properties such as high yield stress and elastic stiffness, low strain hardening rates and low temperature dependence of the flow stress. For this work, samples of amorphous Fe-Cr-Mo-C-B alloys were gradually crystallized and submitted to nanoindentation and nanotribology tests. We discuss the correlation of the changing microstructure to the deformation behavior and the material strength. For instance, while the hardness of the alloy alloy increases with increasing crystallization, the wear resistance decreases due to the formation of a complex nanostructure formed by carbides and intermetallic phases.