Shear Localization in Metallic Glasses

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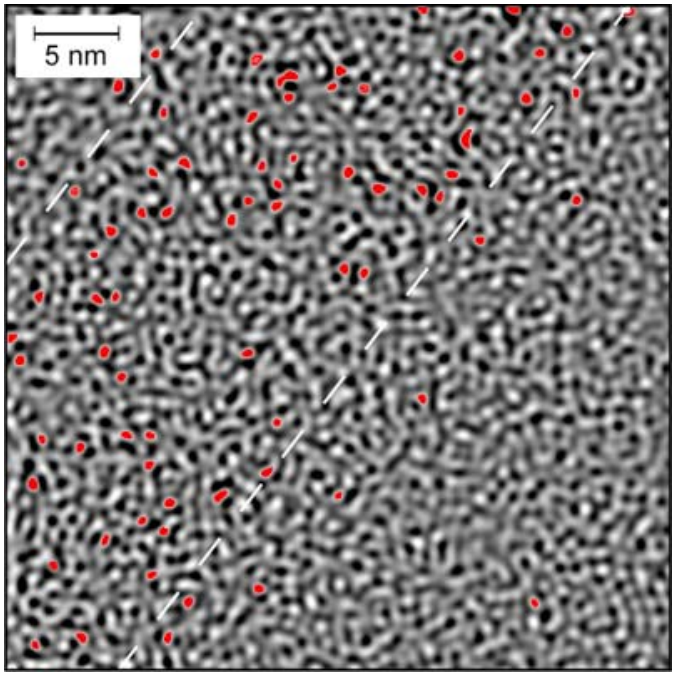
Bulk metallic glasses are a new class of engineering materials that combine the outstanding mechanical properties of metals with the processing flexibility of glasses. Due to their unique disordered atomic-scale structure, metallic glasses deform by the initiation and propagation of shear bands, rather than by dislocation mechanics (as in crystalline metals). Here, we present transmission electron microscopy results revealing nanometer-scale voids inside shear bands, due to the coalescence of excess free volume.

J. Li, F. Spaepen, and T. C. Hufnagel, *Phil. Mag. A* **82**, 2623 (2002)

J. Li, Z. L. Wang, and T. C. Hufnagel, *Phys. Rev. B* **65**, 144201 (2002).



High-resolution transmission electron microscope (HRTEM) image of a shear band (indicated by dashed lines) in a metallic glass. Deformation is caused by an excess of atomic volume in the shear band; when the deformation stops, the excess free volume coalesces into nanometer-scale voids (shown in red).

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Education:

Three undergraduates (Suk-Yeon Hwang, Jenny Nguyen, and Amy Bailey), two graduate students (Xiaofeng Gu and Ryan Ott), and a postdoc (Jing Li) contributed to this work. Nguyen and Hwang have entered graduate school. Gu received his Ph. D. in 2003 and is currently a post-doctoral scholar at the University of Virginia. Ott anticipate receiving his Ph. D. in 2004.Li has gone on to a post-doctoral position at Georgia Tech.

Outreach:

Two students (Dallas Perry and Harry Malecki) from the Baltimore City science magnet high school participated in year-long research projects with our group. Perry is currently studying engineering at the University of Maryland, while Malecki is studying physics at UMBC.

High school student Dallas Perry making ultrasonic measurements on a metallic glass.