

3.032 Mechanical Behavior of Materials

Fall 2007

shear bands (red) forming in
polycrystalline elemental metal
with many line and point defects

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Please see:

http://www-geol.unine.ch/03_france/granites/Granites-Thumbnails/3.jpg

shear bands in granite
(complex crystal) formed
under pressure and
temperature

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Please see:

http://www.ornl.gov/info/ornlreview/v38_1_05/images/a17_golf_full.jpg

<http://www.csem.caltech.edu/graphics/shear-bands.jpg>

Fig. 3 and 4 in Mukai, Toshiji, et al. "Dynamic response of a Pd40Ni40P20 bulk metallic glass in tension." Scripta Materialia 46 (January 2002): 43-47.

bulk amorphous metals

(aka, bulk metallic glasses or amorphous alloys)

- Yielding via shear banding
- Yield stress depends on compression vs. tension

shear bands



Ni-Nb-Sn amorphous metals:

E	~ 200 GPa	(steel)
σ_y (compression)	~ 3 GPa	(3x steel)
σ_y (tension)	~ 1 GPa	(steel)
Strain at failure	~ 1%	(glass)

Image sources: Lu and Liu (Oak Ridge National Lab). www.ornl.gov/v38_1_05/article17.shtml
E. Pekarskaya and W. Johnson (CalTech). www.csem.caltech.edu/Facilities/tem.html
Data sources: Applied Physics Letters, 82: 1030–1032, (2003); TG Nieh, Bulk Metallic Glasses, Ch. 6.

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