Texture and Microstructure in High Strength Cu-Ag Conductors for DC Magnets

National High Magnetic Field Laboratory
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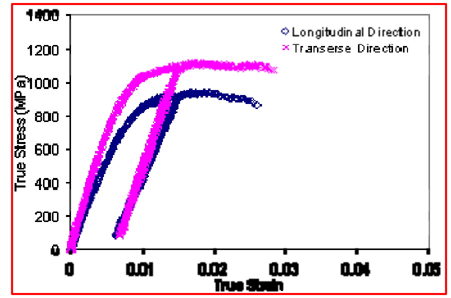
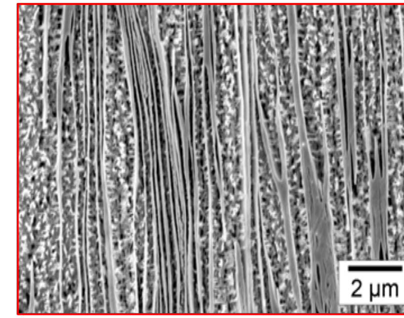
One of the high strength conductors for a high field DC magnet is the Cu-Ag composite. After deformation to large strains, the material evolves into a nanostructured composite that leads to a high strength that is essential in providing high fields to the users. Cold rolling is the preferred method for deformation of Cu-Ag sheet into nanostructured composite. The refinement of the microstructure to nanoscale is accompanied by the development of anisotropy in mechanical and physical properties in addition to development of nanostructure and lattice distortions, as shown in the figure.

The anisotropy in properties is attributed to both the anisotropy in crystallography and defects formed during the deformations. The crystallographic orientation analyses of the texture components in the Orientation Distribution Function (ODF) showed the maxima at {011}<111> in rolled sheets. The deviation from the standard Brass-rolling texture is attributed to the co-deformation of the two phases in nanometer scales via severe plastic deformations. The microstructure shows that the lamellae structures are more uniformly distributed in the transverse section (T-S) direction than those in the longitudinal section (L-S) direction, as shown in the figures. The L-S images reveal that the lamellas are curved, presumably due to the effect of the interaction between shear bands and the lamella during the deformation.

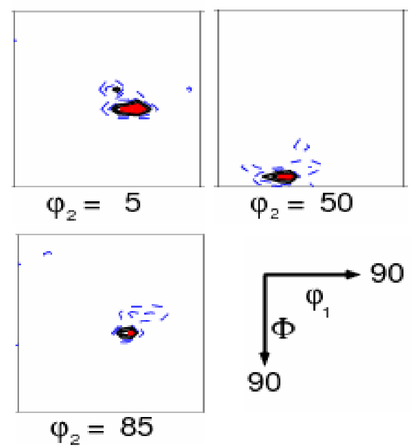
Davy, C.A.; Han, K.; Kalu, P.N. and Bole, S.T., ***IEEE Trans. Appl. Supercond.***, **18** (2), 560 (2008)



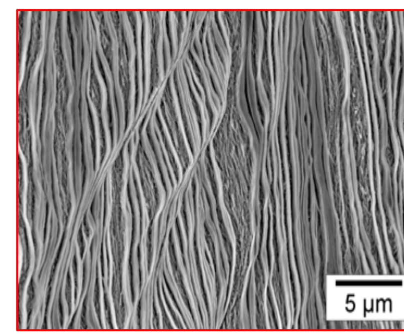
Comparison of the stress-strain curves for a CuAg76wt% in rolling and transverse directions showing that the composite has higher strength in transverse direction.



Scanning Electron microscope image showing aligned silver lamellae in the transverse section view for the CuAg sheet.



Copper phase ODF for the rolled sheet at $\varphi 2$ = 5°, 50°, and 85°. The red area shows the maxima of the texture intensity that is close to {011}<111>.



Aligned lamellae in the longitudinal section for the CuAg sheet.

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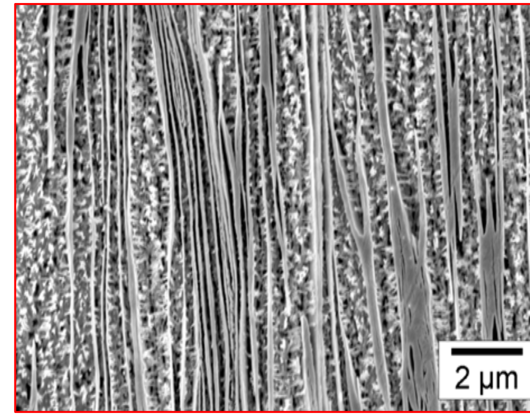
Charney A. Davy received her Bachelor of Science degree from Florida State University with assistance from the Partnership for Research and Education in Materials (PREM) program. She is pursuing her Ph.D. advised by Drs. Peter Kalu and Ke Han.

Her research interests are Texture and Microtexture analysis, Plastic Deformation, Microcharacterization of micro- and nano-structured materials, Mechanical Testing, and Cryogenics.

She is currently undertaking research on eutectic Cu-Ag composites that have the potential to be developed as a high strength conductor for high field magnets.



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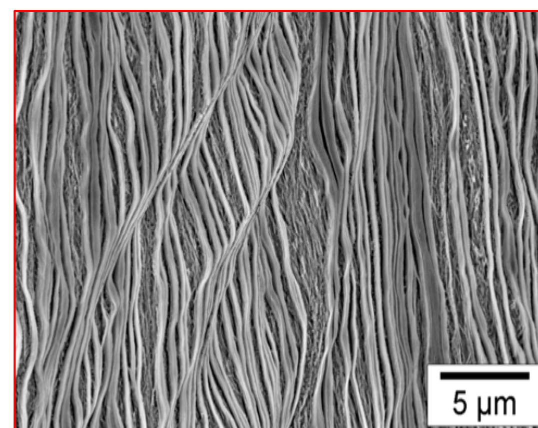

Aligned lamellae in the longitudinal section for the CuAg sheet.

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