

High Strength Composite Conductors

2009 NHMFL Science Highlight for NSF

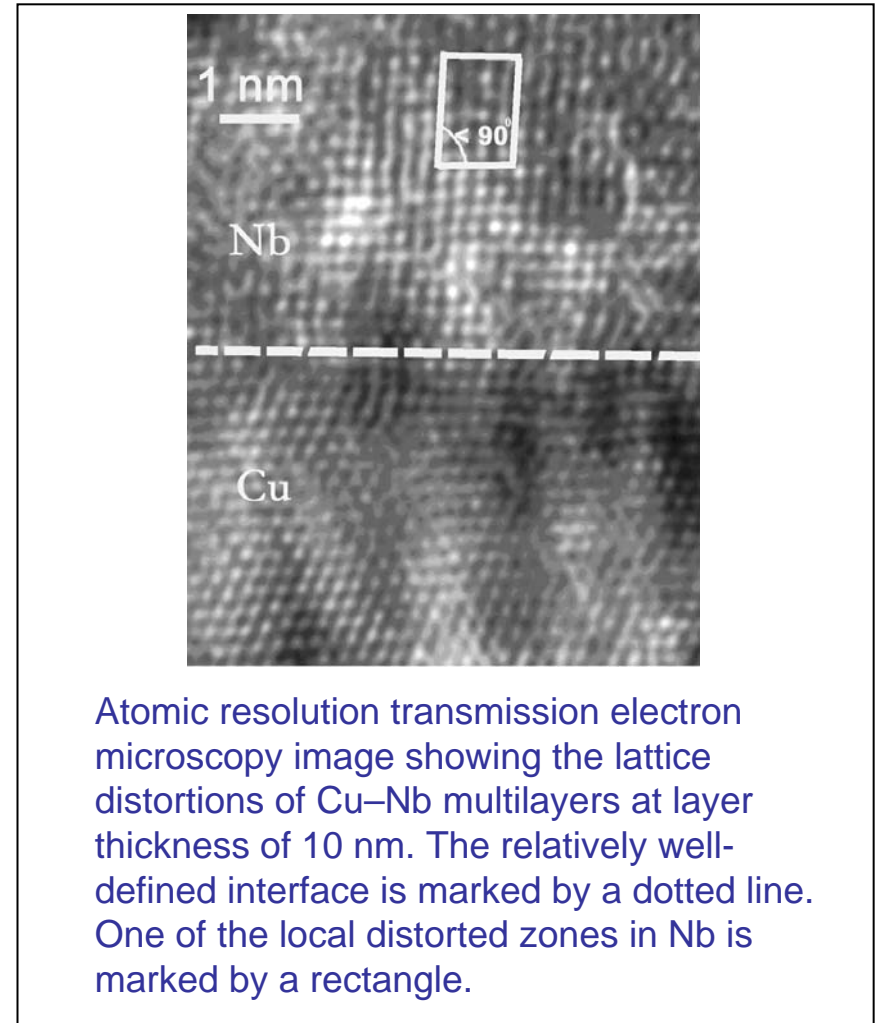
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One of the highest strength conductors is the Cu-Nb nanocomposite. We studied the detailed nature of interfaces in the Cu–Nb multilayered composite system from which the high strength arises. Two types of orientation relationships were observed within 0.1 nanometers in the composite.

As shown in the figure, local regions with large lattice distortions were found in both Cu and Nb together with dislocations and stacking faults in the Cu layers. At the finest bilayer spacing regions, the distortion forces copper to adopt a body-centered cubic structure instead of the equilibrium face-centered cubic structure. These regions are localized and spatially non-uniform.

Future work seeks to correlate these findings with the detailed mechanical and transport properties of nanostructured conductors.



Atomic resolution transmission electron microscopy image showing the lattice distortions of Cu–Nb multilayers at layer thickness of 10 nm. The relatively well-defined interface is marked by a dotted line. One of the local distorted zones in Nb is marked by a rectangle.

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Education: Jonathan Padelford is a REU student who is actively involved in the high strength conductor development in 2009. As his major is in chemistry, he was undertaking research on chemical fabrication of nanocomposite conductors when he was at the Magnet Lab for two months.

International Collaborations

This work is a result of a collaborations among Professor K. Yu-Zhang from the Laboratoire de Microscopies et d'Etude de Nanostructures, Département de Physique, Université de Reims, France, Professor J. D. Embury from the Department of Materials Science & Engineering, McMaster University, Canada and Dr. A. Misra from Los Alamos National Laboratory in New Mexico and K. Han in the NHMFL.

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