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## Mechanical behavior of $\text{Bi}_2\text{Sr}_2\text{CaCu}_2\text{O}_{8+x}$ wire with a detailed study of sample preparation techniques

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High temperature superconductors (HTS) are an enabling technology for superconducting magnets generating magnetic fields greater than 25 T. The development of high field HTS magnets requires not only a conductor capable of carrying sufficient critical current density ( $J_c$ ) at high magnetic field, but also one that is sufficiently strong to withstand the very large Lorentz forces and other stresses during fabrication, handling, and thermal cycling.  $\text{Bi}_2\text{Sr}_2\text{CaCu}_2\text{O}_{8+x}$  (Bi-2212) is the only HTS material available as round wire. Recently, significant progresses have been made to improve the  $J_c$  of Bi-2212 wire by use of over-pressure (OP) processing of the wire during heat treatment. This method has resulted in a more than doubling of the  $J_c$  of the wire to 640 A/mm<sup>2</sup> at 4.2 K and 20 T. However, since Bi-2212 is a brittle material, the effect of these heat treatment changes on the mechanical properties of the material are not well understood.

In this study, a double-restack Bi-2212/AgMg wire was heat treated using a partial melt processing in both pure O<sub>2</sub> and Ar/O<sub>2</sub> atmosphere at various pressures including 1 bar, 50 and 100 bar (OP). The wires then experienced various amount of mechanical strains in both tension and compression. The Bi-2212 wire properties are investigated in various conditions, including green wire, 1 bar and OP-heat treated wires pre- and post-applying mechanical strains. A detailed and efficient polishing procedure is developed to prepare scratch-free specimens and to prohibit introducing filament damages caused during preparation method. The relationships between sample preparation techniques and the filament microstructure, distribution of secondary phases including AEC and Cu-free, and various filament damages are studied using optical, scanning electron and confocal microscopy.

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