**ABSTRACT**

Bi$_2$Sr$_2$CaCu$_2$O$_x$ (Bi-2212) is a high-temperature superconducting compound with a unique property allowing it to be manufactured as a round wire. Sections of wire (4-8 cm) are heated using standard overpressure heat treatment (OP-HT) and quenched, causing crystal growth. A heat-treated sample contains three different shaped bundles. Increased time-in-the-melt results in filament merging within specific bundles in which neighboring filaments bridge together decreasing the performance of the superconductor within the wire. Larger diameter wires allow for more space between filaments which leads to less filament merging and increases supercurrent density. Studying the kinetics of how these filaments merge could lead to better wire architecture and make Bi-2212 more viable in magnet technology.

**PROCEDURE**

Bi-2212 1.0mm wire with 85x18 filaments are heated to 888°C in an overpressure furnace and held at that temperature for varying periods: 1 hour, 2 hours, 4 hours, and 8 hours. The wires are then quenched to room temperature, and 4-8 cm samples are cut and placed in polyfast pucks to analyze the transverse cross-sections. The pucks are ground and polished to remove scratches then examined using two different microscopes: Olympus BX41M-LED Microscope and Scanning Electron Microscope (SEM). Finally, images are captured and the number of filaments per bundle are counted for final analysis.

**RESULTS AND ANALYSIS**

As time-in-the melt increased, filament merging also increased. Among the different shapes within the wire, shape three experienced the most filament merging with a filament count that was 200 less than shapes one and two. A plausible explanation for the significant merging of filaments within shape two is the increase of filament density within the bundle. Another interesting thing to note is the 19% increase in filament size between the 4hr and 8hr samples.

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