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Sat-Mo-Po.08-08: Exploring novel mechanical reinforcement techniques using high-strength ceramic fiber for Bi-2212 magnets

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Bi-2212 multi-filament round wire is a high-field capable, isotropic conductor that does not experience the large screening-current stresses suffered by ReBCO. Together with its high current carrying capabilities, Bi-2212 is a very promising candidate for compact high-field/high-homogeneity magnets. Superconducting coils tend to experience large mechanical stresses under operating conditions. These stresses are mainly caused both by the Lorentz forces during energization and by thermal contraction of the winding pack during cool down. Unlike ReBCO, which contains a strong substrate, Bi-2212 wire is sheathed in a ductile matrix made from Ag-Mg, making it susceptible to large stresses
and, therefore, it requires reinforcement. We have devised a series of experiments to help us investigate several methods for reinforcing a Bi-2212 winding pack. Bi-2212 coils are made in a wind-and-react process, which requires heat-resistant and chemically stable materials for electrical insulation as well as reinforcement. Recently, we have found several strong candidate materials, mostly composed of alumina, that can be used for electrical insulation as well as reinforcement. Several winding composite samples, as well as coils, have been made to study their properties. The gathered data established values for Young's modulus and Poisson' s Ratio at cryogenic temperatures. The experiments also allowed us to compare the feasibility and ease of fabrication using different reinforcement techniques. Results and progress on these ongoing investigations will be presented and discussed.

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