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# Sat-Mo-Or5-01: A study of mechanical and thermal transients associated with magnet quenching due to impregnation material failure

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Eliminating quench training in superconducting accelerator magnets requires understanding the underlying mechanical transients, which include cracking of the impregnation material, interfacial debonding between the impregnation material and conductor, and slip-stick conductor motion; these events can release heat and lead to premature quenching and training. Earlier, we developed a system consisting of a cryogenic probe and tensile tester in order to apply mechanical stress to samples of copper wire embedded in commonly used impregnation materials [1]. The samples were monitored by a shear-piezo transducer and miniature temperature sensor to record acoustic emissions (AE) and local temperature variations. We have now also integrated a capacitive displacement sensor and pulsed spot heater to more accurately measure the sample displacement and thermally calibrate the system. We have tested a range of impregnation materials and reported the AE and temperature change of each to assess each material's suitability for high-field magnet fabrication. A finite element thermomechanical model was developed to estimate the heat released during transient mechanical events based on the observed rise in temperature. We have calculated material-specific ratios of released AE energy to thermal energy to inform future AE-based diagnostics for different event types.

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