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Irreversible tensile stress of 2G HTS wires made by IBAD-MOCVD on Hastelloy substrates

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Irreversible tensile stress was experimentally studied at 77K self field for 2G HTS wires fabricated using the IBAD-MOCVD processes on Hastelloy substrates. The irreversible stress is a critical stress above which the critical current (Ic) retention of a wire is less than 99% of its original Ic after the complete release of the stress. As a characteristic electromechanical property, the irreversible stress defines a critical stress condition at which an unrecoverable mechanical damage to the superconductor starts. Irreversible stress as well as the corresponding irreversible strain was determined for different types of 2G HTS wires with variations in structure, specifically in the thickness of the substrate and/or stabilizer. The effect of the stabilizer to substrate thickness ratio on the irreversible tensile stress was analyzed, in combination with the basic tensile stress-strain relationships of the wires. It was found that the irreversible stress was dependent on a chord elastic modulus determined from the stress-strain curve. The measurement methodology of the electromechanical properties of 2G HTS wires under tension was also discussed.

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