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M2Or1A-05: Development of low loss HTS 2212 wires and cables for ac and ramped field coils

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It is well known from designs analysis and data, that much lighter weight, higher power density and more efficient motors and generators will be enabled by HTS provided it is developed in suitable forms, preferably operating at or above 40 K. Although DC rotors can be wound with HTS tapes, for example 2G, to generate the required 3 to 5 T fields, stators operate in AC mode albeit at lower fields, making it problematic to use tapes due to their high losses in ac fields, requiring instead, HTS as small cross-sectioned, fine-filament wires that are cabled into low-loss transposed forms. Due the challenges of attaining low AC loss with tapes, HTS usage for stators has not been an option. Recent advances however with our HTS 2212 conductor technology have now enabled development of first of their kind HTS wire and cables with loss reducing features specifically designed for HTS stators operating at 30 K or greater. As a first step, the feasibility of producing small diameter, high current density 2212 wires with features required for low ac loss, including non-merged, small sized filaments, short pitch length axial twist have been demonstrated, while also achieving required current densities at >30 K. These wires are already also being used in the development of prototype strong, low loss transposed cables. Test results demonstrate that our 2212 wires with unmerged filament and axially twist meet the minimum required J_e 's identified by compact motor design analysis.

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