Transposed-Cable Coil & Saddle Coils of HTS for Rotating Machines: Test Results at 30K

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Abstract—We have manufactured and tested new HTS coil configurations in order to extend the range of rotating machines to which HTS tapes can be applied. The rotors of large utility generators require operating currents of several kA, which can be achieved by connecting several HTS tapes in parallel in a transposed cable. Design of a generator poses questions on winding technique for the coils, cooling technique at the required operating temperatures around 30K, and VI-relation and stability of such coils. These questions were addressed by winding a test coil using 31m of transposed cable comprising 500m of BSCCO tape and testing it at 30K.
Smaller generators coupled to gas turbines have to work at many thousands of rpm. The high g-forces and need for compactness make it necessary to place the rotor coils as close as possible to the shaft, which requires coils with 3D-bent heads, like in accelerator dipoles. We have produced this type of coils with BSCCO tapes for the first time. After developing a winding technique using simple tooling, 700m of BSCCO tapes were used to manufacture two 3D demonstrator coils, which were tested at 30K as well. We describe winding methods, cooling technique and test results for both types of coils.

Index Terms—superconducting coil, transposed cable, saddle coil, heat pipe

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