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Investigation of the Roebel cable geometry and current homogeneity over lengths relevant to accelerator-type demonstrator magnet.

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A high temperature superconductor accelerator demonstrator dipole magnets are currently under development in frame of the EuCARD2 project. Accelerator magnets require conductor with high overall current density, high field quality and large transverse stress tolerance. REBCO materials which possess uniquely high transport currents at low temperatures and high fields are challenging due to the thin tape geometry. Because of the very high aspect ratio of the tape, new concepts of HTS cables need to be explored, with the goal of having full transposition of the strands, necessary for field quality and current redistribution, acceptable bending ability and a high compaction factor to avoid excessive dilution of the current density. The HTS Roebel cable concept, which was chosen for the coil demonstrators, provides most of the required properties. Up to now short (up to 6 m) and intermediate piece lengths of the cable (24 m) have been prepared. To go beyond first magnet demonstrators, cable lengths of 100 m are needed. Such lengths require characterization of the geometry, tape material as well as of the punched Roebel strand. Besides the material geometry issues, also the influence of critical current properties on the cable is investigated. We are in the process to prepare and assemble dummy cables of 100 m lengths. The geometry of the cable strands will be quantified and qualified with reel-to-reel geometry control system. Cable geometrical uniformities will be compared with tape and strands uniformities. To increase the precision in transposition length, we plan to set up a system that monitors the transposition length in real time and makes corrections using the reel-to-reel system. The tape and strand critical current homogeneity will be investigated using TAPESTAR™ and reel-to-reel transport Ic measurement system (77 K). The characterized current uniformity and its influence on long length cable properties will be studied.

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