Forced flow cooling of HTS CORC cable used in superconducting coil

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Coils for AC applications or for applications with rapid change of the magnetic field have to be produced with low inductance. This usually requires using a cable instead of a single conductor. One of the concepts applicable for coated conductors is Conductor on Round Core cable (CORC). In this solution coated conductors are helically wound on round former. The former can be braid conductor, solid wire or tube. Last written option offers possibility of partial or full cooling by forced flow of coolant inside the tube former.

We tested forced flow cooling method on 4 m long HTS CORC cable wound to form of small coil with non-vacuum thermal insulation made of aerogel and polyurethane foam. Critical current of the coil cooled by forced flow of liquid nitrogen was about 16 % lower than critical current of the same coil cooled by liquid nitrogen bath. From this result we deduced that temperature of superconductor was elevated about 1 K above liquid nitrogen temperature.

In next experiment we have used forced flow cold helium gas. In this way we succeed in reduction of the coil temperature below liquid nitrogen temperatures and thus enhancing the coil performance.