Measurement of major and minor magnetic hysteresis loops of the Ni-alloy substrate in a stack of 2G coated conductor tapes as a function of temperature

Sébastien Brialmont, Jean-François Fagnard, Benoit Vanderheyden *(University of Liege),* Seungyong Hahn, Seong Hyeon Park (*Seoul National University*), Anup Patel (*AAC Technologies*), and Philippe Vanderbemden *(University of Liege)*

We report measurements of the magnetic hysteresis loops of Ni 5%W alloy ferromagnetic substrate in a stack of 2G YBCO tapes cut in the shape of rings from 46 mm wide coated conductors. The stacked rings form a closed magnetic circuit, which is the ideal configuration as they can be magnetized up to high magnetic flux densities without any demagnetization field. The stacked rings can be used as a trapped field magnet or a superconducting shield, in which case the ferromagnetic properties of the substrate can be usefully exploited, even above Tc. When coated conductors are used to carry currents, the magnetic substrate can influence the transport critical current and affect the AC losses. In this work, hysteresis loops and loss measurements in the magnetic substrate are performed at various temperatures between 77 K and 300 K. The results are consistent with literature data obtained on similar substrates at room and liquid nitrogen temperatures. The major contribution to losses comes from the hysteretic component and not from the eddy currents in the frequency range investigated (20 to 200 Hz). Magnetic losses are also reported under the application of minor loops consisting of an AC magnetizing field superimposed to a DC offset field. Such minor loops can be found in power engineering applications including rotating machines or when the superconductor is subjected to ripple voltage from power converters. The results obtained on major hysteresis loops show that the losses are much higher at 77 K than at room temperature. On the contrary, the losses associated with minor loops turn out to be much lower at 77 K than at room temperature.