Imaging of the Surface Resistance of an SRF Cavity by Low-Temperature Laser Scanning Microscopy

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Abstract - Temperature mapping of the outer surface of a superconducting radio-frequency cavity is the technique which is often used to identify lossy areas on the cavity surface. In this contribution, we present 2D images of the superconducting state surface resistance, R_s, of the inner surface of an SRF cavity obtained by low-temperature laser scanning microscopy. This technique [1], which is applied for the first time to study lossy regions in an operating SRF cavity, allows identifying "hotspots" with about one order of magnitude better spatial resolution (~2 mm) than by thermometry. The R_s-resolution is of the order of 1 mW at 3.3 GHz. Surface resistance maps with different laser power and optical images of the cavity surface are discussed in this contribution. It is also shown that the thermal gradient on the niobium surface created by the laser beam can move some of the hotspots, which are identified as locations of trapped bundle of fluxoids. The prospects for this microscope to identify defects that limit the performance of SRF cavities will also be discussed.

Keywords - Laser Scanning Microscopy, Superconducting accelerator cavities, Niobium, Surface resistance.

IEEE/CSC & ESAS European Superconductivity News Forum (ESNF) No. 22 October/November 2012. ESNF Reference No.ST314 Category 6.
The published version of this preprint appeared in *IEEE Transactions on Applied Superconductivity* 23, 3500506 (June 2013).