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Effect of Interstitial Impurities on the Field Dependent Microwaves Surface Resistance of Niobium

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The superconducting properties of niobium radio-frequency accelerating cavities are enhanced when nitrogen impurities are dissolved as interstitials in the material. I will show how the surface resistance is affected by this impurities introduction, in comparison with standard surface treatment for niobium resonators. A variety of 1.3 GHz cavities with different surface treatments (EP, BCP, 120C bake and different levels of N-doping) are studied in order to cover the largest range of interstitial impurities content achievable: from a few to thousands of nanometers of mean free path. Different contributions to the surface resistance will be presented: the BCS and the trapped flux surface resistance. We found that interstitial impurities help to lower the BCS resistance contribution, allowing for a mean free path close to the predicted minimum of BCS resistance as a function of mean free path. Also we found that the trapped flux surface resistance follows a bell-shaped trend as a function of the mean free path and that it depends on the accelerating field.

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