MATTER AND TECHNOLOGIES

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Niobium surface investigation for RF cavity applications

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Thermal treatments of SRF Nb cavities –including the well-established 120℃ bake and the recently reported N-infusion - are shown to improve the cavity performance significantly; however, the underlying physical phenomenon is not fully understood yet. We have chosen a much simpler system of Nb(100) single-crystals heated in different vacuum conditions and nitrogen partial pressures. In-situ X-ray reflectivity and photo-electron spectroscopy measurements were performed to monitor the changes in the elemental species on the surface during thermal treatments. Electron microscopy, x-ray diffraction, energy dispersive X-ray spectroscopy and time-of-flight –secondary ion mass spectroscopy were applied to observe the surface topography, crystallinity and depth profiles of the elements present in the near-surface region. Some samples were treated together with cavities, whose surface properties are also discussed with reference to the cavity-test results.

Primary author: DANGWAL PANDEY, Arti (DESY Hamburg)

Co-authors: Prof. STIERLE, Andreas (DESY); Mr BATE, Christopher (DESY); Dr RESCHKE, Detlef (DESY); Mr DALLA LANA SEMIONE, Guilherme (DESY); Dr WEISE, Hans (DESY); Dr NOEI, Heshmat (DESY NanoLab); SCHAFFRAN, Jörn (FLA); Dr WENSKAT, Marc (DESY); Dr KELLER, Thomas F. (DESY)

Presenter: DANGWAL PANDEY, Arti (DESY Hamburg)

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