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## Near-surface region characterization of nitrogen treated single-crystal Nb (100)

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Modern particle accelerators rely on niobium RF (Radio-Frequency) cavities for their operation and there is a big drive for performance improvement of such devices. Achieving a higher quality factor ( $Q_0$ ), will lead to higher luminosity while reducing the dynamic heat load, resulting in potential cost savings. Nitrogen doping is known to increase the performance of niobium cavities [1], however, the physical and chemical processes and phenomena involved are not yet understood [1,2]. In this work, the niobium (100) surface was subjected to a step-wise preparation based on the so-called 'nitrogen infusion' process, which has recently showed an increase in  $Q_0$  and accelerating gradient for 1.3 GHz SRF cavities [3]. The progressive dissolution of the natural oxide layers upon temperature increase and nitrogen presence were tracked in-situ by means of X-Ray Reflectivity (XRR) while the effects of oxygen and nitrogen interstitials was retrieved from Depth-Resolved Grazing Incidence High Energy Diffuse X-Ray Scattering (GIXRD) measurements obtained at ESRF beamline ID31. Additional surface sensitive characterization techniques, namely X-Ray Photoemission Spectroscopy (XPS) and Scanning Electron Microscopy (SEM) were performed at DESY Nanolab to bring further understanding to the system.

[1] A. Grassellino et al, Supercond. Sci. Technol.26 102001(2013).

[2] P. Dhakal et al, IEEE Tran. on App. Superc.25 3500104(2015).

[3] A Grassellino et al, Supercond. Sci. Technol.30 094004(2017).

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