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M3Or1C-01 [Invited]: Direct observation of nanometer scale niobium hydride ($\text{Nb}_{1-x}\text{H}_x$) on SRF Nb cavity surface using cryogenic atomic force microscopy (AFM)

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Cryogenic atomic force microscopy (AFM) allowed us to directly observe segregation morphology of nanometer size hydride phases ($\text{Nb}_{1-x}\text{H}_x$), which are responsible for Q degradation of superconducting radio frequency (SRF) Nb cavity at high RF field regime. Although niobium hydride has been recognized with cryo-optical microscopy, electron diffraction or ion mass spectroscopy, identification of nm-scale Nb hydride segregation in terms of saturation temperature has never been accomplished due to difficulties on direct observation at cryogenic temperature. In this study, we address the first direct observation of nanometer size hydride segregation on the surface of superconducting RF niobium cavities as a function of cooling temperature, and quantitatively compare its segregation morphology with respect to state of art cavity treatments.

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