TOF-SIMS ANALYSIS OF HYDROGEN IN NIIOBIUM, FROM 160ºK TO 475ºK

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Abstract

Niobium (Nb) is the material of choice for superconducting radio frequency (SRF) cavities due to its high critical temperature and critical magnetic field. Interstitial impurity elements such as H directly influence the efficiency of these cavities. Quantification of H in Nb is difficult since H is extremely mobile in Nb with a very high diffusion coefficient even at room temperature. In the presented work, Time of Flight Secondary Ion Mass Spectrometry (TOF-SIMS) was used to characterize H in Nb over a wide temperature range (160ºK to 475ºK) in situ to check for changes in mobility. Multiple experiments showed that as the specimen temperature is decreased below 300 ºK, the H/Nb intensity changes by first increasing and then decreasing drastically at temperatures below 200ºK. As specimen temperature is increased from 300ºK to 450ºK, the H/Nb intensity decreases. Remarkably, the H intensity with respect to Nb increases with time at 475ºK (approximately 200ºC). Correlation between this data and the H-Nb phase diagram appears to account for the H behaviour.

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