SRF2025 TOKYO

22ND INTERNATIONAL CONFERENCE ON RF SUPERCONDUCTIVITY

September 21-26, 2025

Contribution ID: **64** Contribution code: **TUB07C** Type: **Contributed Oral Presentation**

Study of niobium surface under ultra hight vacuum after heat treatment for SRF cavities

Tuesday 23 September 2025 12:55 (15 minutes)

Specific heat treatments applied to superconducting radio-frequency (SRF) cavities, such as nitrogen infusion or Mid-T baking, aim to improve the quality factor (Qo) at medium accelerating fields (˜10–20 MV/m). These treatments reduce the BCS surface resistance by tuning the mean free path of niobium over a few hundred nanometers, either by diffusing oxygen from the native oxide layer or by diffusing nitrogen after the dissolution of the oxide layer. However, these treatments preclude the usual chemical polishing, as it would reverse the beneficial effects of the heat treatments, making the cavities highly sensitive to surface contamination. In particular, the formation of niobium carbides, which can mask the expected benefits, strongly depends on the annealing conditions, surface preparation, and the material's history. Several hypotheses are considered regarding the origin of carbon: vacuum contamination, surface pollution, or internal migration from the niobium itself, potentially enriched with carbon during previous chemical treatments (BCP, EP).

This work aims to identify the primary source of carbon responsible for niobium carbide growth, using techniques such as X-ray photoelectron spectroscopy (XPS), scanning electron microscopy (SEM), and secondary ion mass spectrometry (SIMS). This study will also help identify the key influencing parameters, in order to better understand and reduce their impact on SRF cavity performance.

I have read and accept the Privacy Policy Statement

Yes

Footnotes

Funding Agency

Author: BOUTELAA, Chahinez (Centre National de la Recherche Scientifique)

Co-authors: LONGUEVERGNE, David (Institut National de Physique Nucléaire et de Physique des Particules); SATTONNAY, Gaël (Institut National de Physique Nucléaire et de Physique des Particules); KOLB, Philipp (TRIUMF); LAXDAL, Robert (TRIUMF)

Presenter: BOUTELAA, Chahinez (Centre National de la Recherche Scientifique)

Session Classification: Tuesday Oral Session: B

Track Classification: MC3: Cavities