Growth of niobium based composite nano-layers for SRF accelerating cavities.

In the frame of a close collaboration, three laboratories namely Institut de Physique Nucléaire d'Orsay (IPN), Centre de Spectrométrie Nucléaire et de Spectrométrie de Masse (CSNSM) and the Institut de Recherche sur les lois Fondamentales de l'Univers (IRFU-CEA Saclay) offer a post-doctoral position granted by de cluster P2IO (www.labex-p2io.fr).

Superconducting radiofrequency resonators made with bulk niobium of high purity are increasingly used in linear particle accelerators (CEBAF, SNS, XFEL,…). However the accelerating gradient record reached with a single cell cavity for ILC (KEK design) is just below the theoretical limit (52.8MV/m for Bc=200mT). In order to improve RF performances of the cavities, the development of new superconducting materials with higher critical magnetic field and critical temperature than bulk niobium is mandatory. An alternative - based on A. Gurevich model - is to deposit a multilayer assembly of high Tc type II superconductor with thickness smaller than λ_L with a dielectric material (Superconductor-Insulator-Superconductor) onto a bulk niobium substrate. This kind of nanocomposite materials could improve both the maximum accelerating gradient and cryogenic efficiency of the future machine. Our group formed since one year benefits of their experiences in film growing, local characterization of physical properties and measurements of RF properties. The aim is to develop, characterize and optimize the deposition process on samples then to apply it to a prototype bulk niobium SRF cavity. To prove the efficiency of such composite assemblies, the choice of the materials and the deposition technique are critical. Preliminary results with the NbN/MgO system highlight the enhancement of critical magnetic field [1].
The model samples will be produced using molecular beam epitaxy technique. The chosen superconducting material is based on Niobium (NbN, NbAl,…) and results will be compared with CVD techniques. The optimization will be performed using surface and material analysis tools (XPS, RBS, MEB,…), local magnetization measurement and RF characterization with a TE011 cavity.

Strong experimental activities are an essential part of this position. A PhD in physics and deposition techniques (CVD, magnetron sputtering,…) is required to apply along with an experience in surface characterization techniques, important experimental skills and/or work in SRF environment. Starting 1st October 2012, this position will last two years. Potential candidates who completed their PhD within the last two years will be preferred. The salary will correspond with one of levels from young scientist of CNRS according to their experience.
The applicant will have to send his cover letter (1 page) and resume including a list of publications together with three referees letters with referee's names and addresses until the 30/06/12 to Dr. Guillaume Martinet (martinet@ipno.in2p3.fr), Dr. Franck Fortuna (fortuna@csnsm.in2p3.fr) and Dr. Claire Antoine (claire.antoine@cea.fr).

[1] C.Z. Antoine, et al., *Characterization of superconducting nanometric multilayer samples for SRF applications: first evidence of magnetic screening effect*, PRST AB 13 (2010) 121001.