Arc deposited Pb and Nb films for SRF accelerator technology.

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Lead and niobium are superconducting metals which are promising for accelerator technology. Niobium thin film coated copper resonant cavities are being developed an alternative for those made of bulk Nb. Lead which exhibits the highest quantum efficiency between superconducting metals is investigated as a robust material for superconducting electron injector photocathodes [1]. This year we continued structural studies of thin Pb/Nb, Nb/Cu and Nb/sapphire films samples.

Degradation of Pb/Nb films The aim of those measurement was to identify the compounds formed on deposited Pb cathode film as a result of air exposure. Two Pb/Nb samples were investigated. One of them was put into Ar environment immediately after a deposition and kept 14 days, the other was treated in similar way but in N_2. The measurements were done immediately after the storage and showed a presence of a compound, which occurs in the sample stored in N_2 only. The measurement done for both samples 10 h later showed different phases formed as a result of interaction with air. Also the products of interaction with water were different: the layer kept in Ar dissolved completely, while another unidentified remained on the sample kept in N_2.

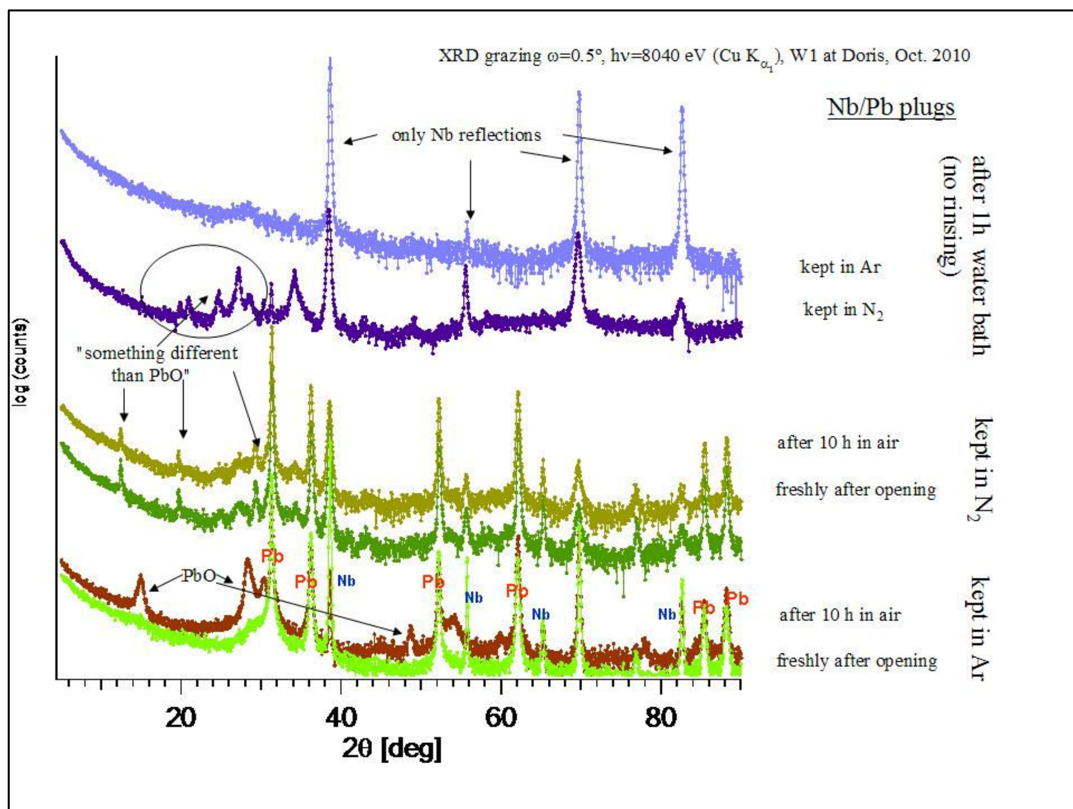

Fig. 1 XRD patterns measured for Pb/Nb films treated in various conditions (see the text).

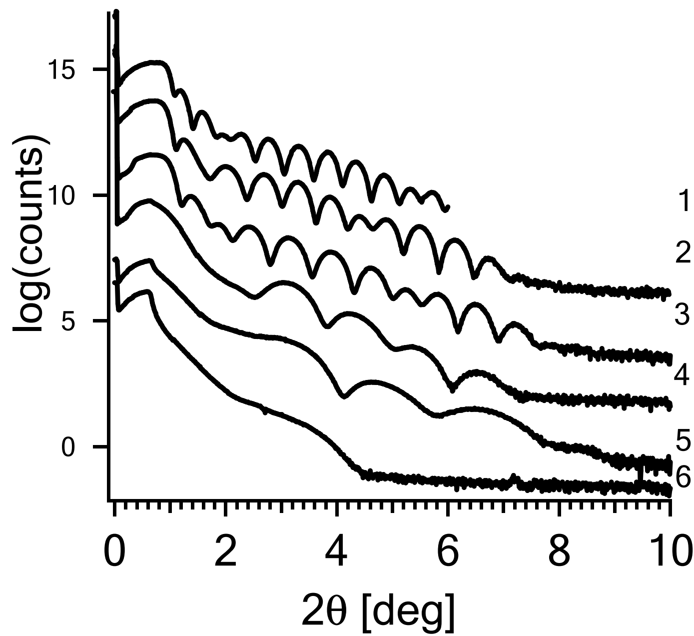

Fig. 2 Reflectivity patterns measured for Nb/sapphire samples.:
1 – 10 s , 8.3 nm
2 – 6 s, 7.3 nm
3– 3 s, 5,6 nm
4 – 2s 3.5 nm
5 – 1s
6 – shorter than 1 s

X-ray refelctivity studies of Nb/sapphire(001). Measurement were done at W1 beamline for a number of samples differing in deposition time. Rough analysis allowed to determine film thicknesses. Observed complex shape of interference pattern indicated the presence of a number of constituent layers.

XAFS studies of Nb/Cu(001). Measurement were done at X beamline for a number of samples differing in thickness. Fine structure oscillations observed for 3,5 nm were found in the limited k range only. In this range, they differ from the oscillations measured for 15 nm sample.

Results obtained from both XRR and XAFS measurements will be interpreted in terms of identification of amorphised Nb phase in the interface region.

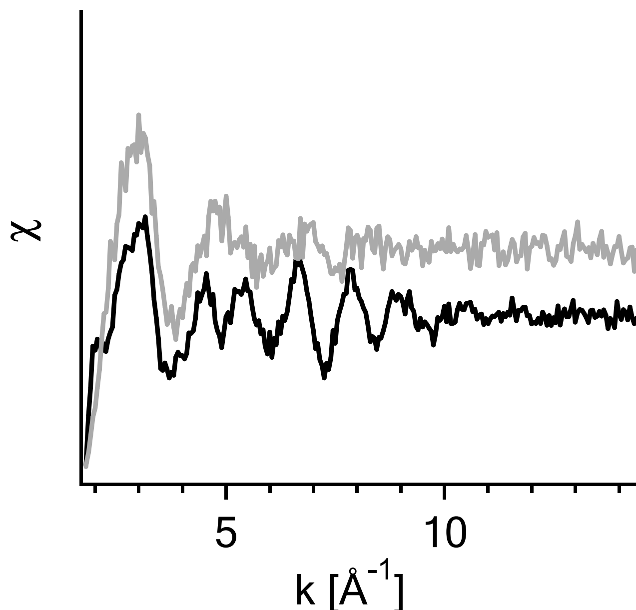

Fig. 3 EXAFS measured for 15 nm (black) and 3.5 nm (grey) Nb/Cu(001) films.

Reference

[1] R. Nietubyć, T. Rao, J. Sekutowicz, P. Kneisel, Proc of IPAC10, Kyoto, Japan, p.4068 (THPEC020)