Study of Nb/Al Interface Combining Spectroscopy of Reflected Electrons with Ion Sputtering

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Abstract - The study of the interface between Nb and Al thin films is motivated by the fact that electrical characteristics of Nb/AIAlO$_x$/Nb superconductive tunnel junction are very sensitive to the structure of the interfaces in the trilayer. We present a method of interpretation of energy spectra of electrons reflected from layered samples, with the help of which we can determine depth profiles and morphologies of interfaces inside Nb/AIAlO$_x$/Nb structure with a nanometre resolution. Methodological specifics of the method is accounting for the whole spectrum recorded in a wide range of energy losses, rather than limited to interpretation of certain peaks as in REELS. We reconstruct depth profile data by fitting calculated spectra to recorded ones. The calculations are based on solution of boundary problem of electron transport equation in multi-layered slice-uniform media, as well as on Monte-Carlo modelling. The Nb/Al interface was found to have an intermediate layer of about 3 nm thick as-deposited which developed into about 6 nm thick layer as a result of annealing at 180ºC for 20 minutes.

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