Growth of AlOx tunnelling barriers via oxidation of Al in thermalized atomic oxygen atmosphere

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Thin insulating *AlOx* layers have become important parts of the devices like magnetic or superconducting tunnelling junctions, state of art transistors and radiation sensors. Widespread implementation of Aluminium Oxide *AlOx* is concerned with easy fabrication procedure that consists in exposure of metallic Al to oxygen atmosphere. Nevertheless, the oxidation in near ambient O_2 conditions is known to be a self-limited process, which gives rise to the *AlOx* layers of ~ 2nm and dispersion of the thicknesses of ~50% [1]. The lack of tuneability in this method motivates the usage of an oxygen-plasma atmosphere to induce the oxidation. Accelerated oxygen ions produced via electrical discharge or due to application of the radio-frequency electromagnetic fields were found to be capable of creating homogeneous *AlOx* layers of variable thicknesses despite the effect of granularity of the metallic Al films [2]. But using of oxygen plasma has the counter part of generating some stoichiometric problems along the process, like a presence of oxygen-rich layers, which can oxidize the upper electrode or provoking appearance of metastable two-state systems, which is a source of noise in the radio-frequency circuits [3]. In this talk I will report on the alternative growth technique of the *AlOx* layers that consists in exposure of thin Al films to thermalized atomic oxygen atmosphere of 3-4 mbars. I will present the results of combined spectroscopic photoemission characterization of the continuous *AlOx* layers and transport measurements of Al-*AlOx*-Al Josephson Junctions performed in a dilution refrigerator at a base T of 8mK. These data will demonstrate the advantages of using atomic oxygen in comparison to oxidation in molecular O2 or by means of the accelerated O ions.

References

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Figures

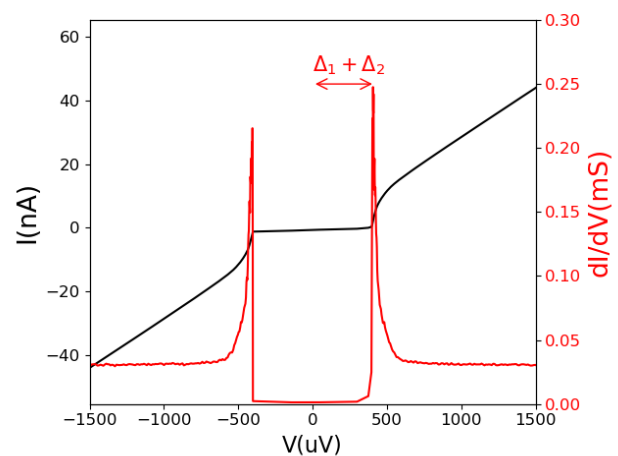

Figure 1: Tunnel spectroscopy of a Al-AlOx-Al tunnel barrier at 8mK.