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Enhanced T_C in granular and thin film Al-Al_2O_3 nanostructures[1]

J. S. HIGGINS, R. L. GREENE, Center for Nanophysics and Advanced Materials, Department of Physics, University of Maryland — It is known since the 1970s that the superconducting transition temperature of granular aluminum films can be as high as two to three times the transition temperature of bulk aluminum, depending on the grain size and how strongly the nanometer size grains are connected[1,2]. As the strength of the grain connectivity becomes increasingly weak, the enhanced T_C is suppressed. The mechanism behind this enhancement is still under debate. Recently, work on larger aluminum nanoparticles (18nm) embedded in an insulating Al_2O_3 matrix showed an onset of the superconducting transition as high as three times that of bulk aluminum[3]. In this situation, the Al grains are electrically disconnected and in a regime far removed from that of the granular films. Here we compare the two situations through electronic and thermal measurements in order to help elucidate the mechanism behind the enhancements. [1]S. Pracht, *et al.*, arXiv:1508.04270v1 [cond-mat.supr-con] (2015). [2]G. Deutscher, *New Superconductors From Granular to High T_C*, New Jersey: World Scientific, 2006, p. 72-74. [3]V. N. Smolyaninova, *et al.*, Sci. Rep. **5**, 15777 (2015).

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