

Abstract Submitted
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Magnetization controlled superconductivity in a Pb film on a perpendicular array of ferromagnetic Co nanowires¹ ZUXIN YE, DAYA RATHNAYAKA, WENHAO WU, HAIDONG LIU, HONG ZHANG, DONALD NAUGLE, IGOR LYUKSYUTOV, JOSEPH ROSS JR., Texas A&M University — We report the studies of superconductivity in a Pb film on a perpendicular array of ferromagnetic Co nanowires. We first evaporate a Pb film of 300nm in thickness on a 60 μ m-thick porous Al₂O₃ membrane as the cathode for electroplating. Cobalt nanowires 100nm in diameter were electrochemically deposited in the pores starting from the Pb film. Scanning electron microscopy images showed uniform distribution of cobalt nanowires. The magnetization of the individual Co nanowires should be oriented perpendicular to the Pb film due to the high aspect ratio of the Co nanowires. We have observed significant difference in the superconducting behavior of the Pb film between zero-field cooled experiments and field-cooled experiments. In field-cooled experiments, the samples are cooled from room temperature to 20 K in fields of 1-5 T applied along the direction of the Co nanowires. This field aligns the magnetization of the Co nanowires, and as a result, enhances the superconducting transition temperature by 1.5-2.0 K in comparison to zero-field cooled experiments in which case the magnetization of the nanowires is not aligned. These experimental data support recent theory by I. F. Lyuksyutov et al. [PRL **81**, 2344(1998)].

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