# Nanoscale microstructure and magnetic transport in AlN/Co/AlN/Co... discontinuous multilayers

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## Abstract

Microstructure and magnetic transport phenomina in rf sputtered AlN/Co type ten-layered discontinuous films of nanoscaled [AlN (3 nm)/Co (t nm)]$\ldots_{10}$ with $t_{Co}$=1.0~2.0 nm have been investigated. The microstructure and tunneling magnetic resistance of the samples are strongly dependent on the thickness of Co layer. Negative tunneling magneto-resistance due to the spin-dependent transport has been observed along the current-in-plane configuration in the samples having the Co layers below 1.6 nm thick. When the thickness of Co layer was less than 1.2 nm, randomly oriented granular Co particles were completely isolated and embedded in amorphous AlN matrix, and the films showed the superparamagnetic behavior with a high MR value of $\Delta\rho/\rho_0$=1.8 % . As $t_{Co}$ increases, a transition from the regime of co-existence of superparamagnetic and ferromagnetic behaviors to ferromagnetic behavior was observed. Tunneling barrier called "decay length for tunneling" for the films having the thickness of Co layer from 1.4 to 1. 6 nm was measured to be ranged from 0.004 to 0.021 $Å^{-1}$.

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