Electrical and magnetic properties of Fe$_3$O$_4$ films on highly crystalline Cu(111) islands

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Physical properties of interface between transition metal and ferrimagnets had been long interests in various applications such as spintronics, magnetic tunnel junction, magnetic recording media. In this work, the epitaxial Fe$_3$O$_4$ film, one of ferromagnetic oxides was synthesized using sputtering methods on Al$_2$O$_3$(0001) substrates. Varying the population density of metallic Cu(111) islands on the substrate, the magnetic and electrical properties of (111) oriented Fe$_3$O$_4$ films were examined. With (111) oriented Cu island, the increased carrier concentration and electrical conductivity were observed. However, the saturation magnetization was decreased owing to the presence of intermixing between Cu and Fe$_3$O$_4$. The detailed interfacial chemistry and island density depended physical properties will be discussed.

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