Ab initio study of magnetic properties of Mn nanowires on Fe(001) surface

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Nanostructures deposited on ferromagnetic surfaces have attracted considerable attention due to novel magnetic properties [1,2]. One of the magnetic properties of nanostructures which play an important role in the design of new magnetic devices is the magnetic interaction between the constituent atoms. Depending on the strength and sign of the exchange interaction, the nanostructure can be driven into ferromagnetic, antiferromagnetic or very complex spin structures [1-3]. A complex noncollinear magnetic structure have been recently reported for reconstructed Mn films on Fe(001) [2]. Here, motivated by these results, the magnetic structures of Mn nanowires supported on Fe(001) surface are investigated with noncollinear first-principles theory. The calculations have been performed using the real-space linear muffin-tin orbital method (RS-LMTO-ASA) [3,4]. The complex magnetic behavior in these nanosized wires is discussed. The role of the magnetic exchange interaction between two neighboring wire atoms in the chain, and between a given wire atom and its neighboring surface atoms beyond the nearest neighbors is investigated.

Keywords: Magnetic nanostructure, magnetic exchange interaction, noncollinear magnetism.

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