Abstract

Using spin density functional theory (SDFT) calculations, we have studied the magnetic states, including collinear and noncollinear magnetic interlayer coupling, of Fe1-xCox ultrathin films sandwiching Rh(001) layers. We found very large values for the interlayer exchange coupling (IEC) in Co/Rhn/Co or (FeCo)m/Rhn/Co structures as compared to, e.g., Ag or Au spacer layers. The IEC oscillates with the Rh spacer thickness showing a transition between strong antiferromagnetic and ferromagnetic coupling between five- and seven-layer thickness of the Rh film. Moreover, depending on the thickness of the FeCo film, a reorientation transition between in-plane and out-of-plane easy axis was found when spin-orbit coupling is considered in the calculations. This result suggests that, for specific arrangements such as (FeCo)2/Rh5/Co structures, a competition between IEC and magnetic anisotropy of coupled films may result in noncollinear ordering. This possibility was studied with constrained, noncollinear SDFT calculations and the results were mapped onto a classical spin model to explore the richness of spin structures that can arise in these multilayer systems