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Fabrication of $Fe_3Si/FeSi_2$ Multilayers by Facing Targets Direct-Current Sputtering And The Magnetic Properties SHIN-ICHI HIRAKAWA, KEN-ICHIRO SAKAI, Kyushu University, KAORU TAKEDA, Fukuoka Institute of Technology, TSUYOSHI YOSHITAKE, Kyushu University — Fe-Si system has various phases such as semiconducting β-$FeSi_2$ and nanocrystalline $FeSi_2$, and ferromagnetic Fe_3Si. An $Fe_3Si/FeSi_2$ multilayer is a new candidate for a ferromagneto/semiconductor heterostructure in spintronics. In order to accumulate the same kind of materials in atomic scale and form a layered structure with sharp interlaces, the interdiffusion of atoms between the layers should be suppressed. Sputtering methods has been applied for a variety of film preparations. Among them, a facing target direct-current sputtering (FTDCS) method has a merit that a film receives less damage during the deposition since a substrate is placed away from plasma. In this study, we employed the FTDCS method and prepared Fe_3Si (25 Å)/$FeSi_2$ (X Å) multilayers, wherein the $FeSi_2$ layer thickness X was changed between 5 and 20 Å. Their structural and magnetic properties were investigated. The X-ray diffraction measurement indicated that the Fe_3Si layers are epitaxially grown not only on Si(111) but also up to the top layer across the $FeSi_2$ layers. From the magnetization curves measured at room temperature, it was found that the antiferromagnetic and ferromagnetic interlayer couplings are alternatively induced for a change in the $FeSi_2$ layer thickness X.

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