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The Electronic Structure and Magnetism of Superlattices Consisted of Heusler- and Zinc-blende Structured Half-metals

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The half-metallic Heusler compound [1] and the zinc-blende (ZB) structured half-metals [2,3] have attracted much attention, since they have large magnetic moment and high curie temperature. In this study, we investigated the electronic structure and magnetism of superlattice systems consisted of Heusler compound Co_2MnSi (CMS) and ZB MnAs (MA) by means of the all-electron full potential linearized augmented plane wave(FLAPW) method [4,5] within the generalized gradient approximation (GGA) [6]. We considered four superlattice systems, the CMS(m=2,4)/MA(n=2,4), constructed by the alternatingly arrayed thin films of m(=2,4)-layer Co_2MnSi(CMS) and n(=2,4)-layer MnAs(MA) along the [001] direction. The calulated total magnetic moments and the total density of states (DOSs) showed, unfortunately, that all four superlattice systems are not half-metallic. We found that the Mn atoms are antiferromagnetically coupled in the systems of CMS2/MA2 and CMS2/MA4. By comparing the atom-resolved DOSs of the superlattice systems with those of bulk Co_2MnSi and MnAs, we discuss the influences of the symmetry change to the magnetism and half-metallicity in the superlattice systems.

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Structure and Magnetic Properties of $Fe_{73.5}Si_{13.5}B_9Nb_3Cu_1$ Alloy Nano Powder Fabricated by Chemical Etching Method and Milling Procedure

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An $Fe_{73.5}Si_{13.5}B_9Nb_3Cu_1$ alloy, known as FINEMET, is an attractive soft magnetic material, which finds use in electric power applications such as transformer cores and other inductive devices. It exhibits excellent permeability (~ 10^5 at 1kHz), a low saturation magnetostriction (~ 2 x 10^{-6}) and a relatively high saturation magnetization (~ 1.2 T).

The magnetic and structural properties of FINEMET nano powder with a composition of $Fe_{73.5}Si_{13.5}B_9Nb_3Cu_1$ in wt% were investigated after annealing, chemical etching and mechanical milling. The primary and secondary crystallization temperatures and crystalline peaks are 523 ^oC and 550 ^oC, respectively. The grain size of particles was adjusted by annealing time. Optimally annealed particles exhibited a homogenous microstructure composed of nanometer-sized crystalline grains. The grain boundary of annealed particles was etched preferentially by chemical etching method. Chemically etched particles were broken at grain boundary by high-energetic ball milling method. As a result, nanometer-sized FINEMET powder with a same size of crystalline grains was fabricated

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