# Magnetotransport properties of Heusler-type spin-gapless systems

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Because of potential applications for electric-field induced modulations of physical properties, spin-gapless semiconductors (SGSs) have been widely explored in the field of spintronics [1]. Recent theoretical calculations revealed that some ternary or equiatomic quaternary Heusler alloys such as $Mn_2CoAl$ (MCA) and CoFeVSi (CFVS) have SGS-like electronic band structures [2,3]. Up to now, for bulk MCA [2], positive, non-saturating, and linear magnetoresistance (MR) curves, one of the unique magnetotransport properties in SGSs, have already been observed. However, there is no report on such behavior in thin-film samples for spintronic device applications. Here we explore magnetotransport properties of epitaxial MCA and CFVS films grown by molecular beam epitaxy (MBE) [4,5].

Figure 1 displays MR ratio of CFVS and MCA films as an external magnetic field measured at various temperatures. For CFVS [Fig. 1(a)], positive, non-saturating and linear MR curves are observed, similar to other SGS materials even for thin-film samples. From Hall-effect measurements, charge carriers were varied from holes to electrons with decreasing external temperatures, meaning that the Fermi level is located near the center between valence-band edge and conduction-band one. For MCA [Fig. 1(b)], on the other hand, only negative MR curves are seen, being different from bulk-MCA [2]. From these results, we infer that, in our MBE growth conditions, CFVS easily forms a SGS-like electronic band structure compared with MCA.

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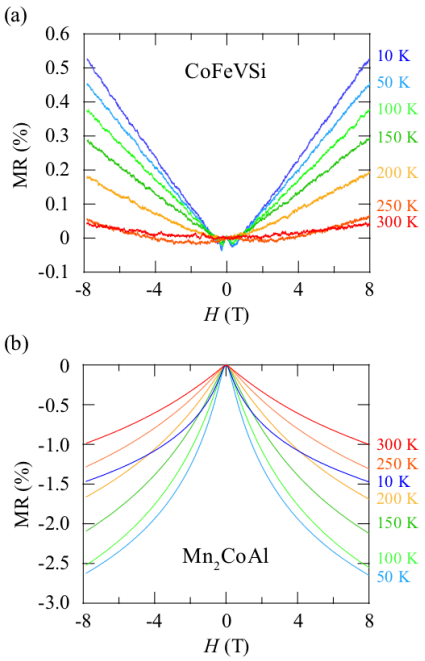


**Fig. 1** *MR* curves for CoFeVSi and $Mn_2CoAl$ films measured at various temperatures.