Anomalous Hall effect and current spin polarization in Co-based Heusler compounds

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Co-based Heusler compounds are ferromagnetic with a high Curie temperature and a large magnetization density, and thus are promising for spintronic applications. We have recently performed systematic ab initio studies of two principal spin-related phenomena, namely, anomalous Hall effect and current spin polarization, in Co₂-based Heusler compounds Co₂XZ (X = Cr, Mn and Fe; Z = Al, Ga, In, Si, Ge, Sn) in the cubic L2₁ structure within the density functional theory with the generalized gradient approximation [1,2]. In this presentation, we will report the interesting findings of these investigations. In particular, we predicted that the charge Hall current in most of the Co-based full Heusler compounds would be almost fully spin polarized even though many of them do not have a half metallic band structure, suggesting that these Co-based Heusler compounds may be called anomalous Hall half-metals and could have valuable applications in spintronics. These interesting findings will be discussed in terms of the calculated electronic band structures, magnetic moments and also anomalous and spin Hall conductivities as a function of the Fermi level.
