Optical properties of $Co_2FeAl_{0.4}Si_{0.6}$ and $Co_2FeGa_{0.5}Ge_{0.5}$ half-metallic Heusler compounds

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Commonly materials for plasmonic applications are gold and silver, as they provide low damping and negative value of real part of the permittivity. Nowadays, there is a need of new materials, which can provide both plasmonic excitations and magneto-optical activity. Co_2-based half metallic Heusler compounds are promising materials for this purpose, as there are several similarities in electronic band structure for exited states between gold, silver and the majority band of Co_2-based Heusler compounds. Namely in both cases the 3d-electrons are buried below the Fermi level and the electrons on the Fermi level are dominated by 4s electrons. Hence, for photon energies smaller than Heusler's minority band gap size (being typically 1eV), only majority electrons contribute to the photon absorption. Hence, for photon energies smaller than the minority electron gap size, the Heusler compounds are promising to provide similar optical properties as gold or silver. Furthermore, Co_2-based Heusler compounds have magneto-optical Kerr effect of similar strength as other 3d-ferromagnets (Fe, Co) as well as they provide high Curie temperature (up to 1000K) [1]. Hence, the half-metallic Heusler compounds are promising materials for magneto-plasmonic applications.

Within this contribution we present complex refractivity index, determined in range from mid-IR to near-UV, of half-metallic Heusler compounds $Co_2FeAl_{0.4}Si_{0.6}$ and $Co_2FeGa_{0.5}Ge_{0.5}$. Their composition optimizes half-metallic behavior [2], i.e. reducing contribution of minority band to the optical absorption for small (below 1eV) photon energies.

References

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