Effect of Magnetism on Lattice Vibrations

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An effect of magnetism on lattice dynamics is considered as negligible. Such belief is based on calculations according to which the spin susceptibility of metal is not affected by the electron-phonon interaction (EPI) ([1] and references therein). Indeed, the effect of the EPI was estimated as $\frac{\hbar\omega_D}{\varepsilon_F} \approx 10^{-2}$ ([1] and references therein) where ε_F is the Fermi energy, and $\hbar\omega_D$ is the Debye energy. However, Kim showed [1] that the influence of the EPI on spin susceptibility can be significantly, i.e. by a factor of $\sim 10^2$, enhanced by exchange interactions between electrons. In other words, the effect of the EPI on magnetic properties of metallic systems, and *vice versa*, is much more significant than generally believed. The Mössbauer spectroscopy (MS) is a well-suited method for studying the lattice dynamics via two spectral parameters viz. (1) center shift, CS, and (2) recoil-free factor, *f*. The former gives information on an average squared velocity of vibrations, $\langle v^2 \rangle$, while the latter is related to average squared amplitude of vibrations, $\langle x^2 \rangle$. Presented and discussed will be relevant results obtained with the MS for sigma-phase Fe-Cr and Fe-V alloys [2,3], C14 Laves phase $NbFe_2$[4], spin-density waves Cr doped with ^{57}Fe [5], and last but not least, the effect of magnetism on sound velocity in the σ-FeCr alloy studied with the nuclear inelastic scattering of synchrotron radiation [5].

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