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Effect of magnetism on lattice dynamics as seen by Mössbauer spectroscopy

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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 $E_D/E_F=10^{-2}$ ([1] and references therein) where E_F is the Fermi energy, and E_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 100, 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, $<v^2>$, while the latter is related to average squared amplitude of vibrations, $<x^2>$. 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 [6].

Refs
[1] D. J. Kim, Phys. Rep. {\bf 171}, 129 (1988).
[2] S. M. Dubiel {\it et al.}, EPL {\bf 101}, 16008 (2013).
[3] S. M. Dubiel and J. Żukrowski, J. Magn. Magn. Mater., {\bf 441}, 557 (2017).
[4] J. Żukrowski and S. M. Dubiel, J. Appl. Phys. {\bf 123}, 223902 (2018).
[5] S. M. Dubiel {\it et al.}, J. Phys.: Condens. Matter {\bf 22}, 435403 (2010).
[6] S. M. Dubiel and A. I. Chumakov, EPL {\bf 117}, 56001 (2017).

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