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Application of the Mössbauer effect to the study of subnanometer harmonic displacements in thin solids

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Abstract

© 2017 American Physical Society. We measure subnanometer displacements of thin samples vibrated by piezotransducer. Samples contain Fe57 nuclei, which are exposed to 14.4-keV γ radiation. Vibration produces sidebands from a single absorption line of the sample. The sideband intensities depend on the vibration amplitude and its distribution along the sample. We developed a model of this distribution, which adequately describes the spectra of powder and stainless steel (SS) absorbers. We propose to filter γ radiation through a small round hole in the lead mask, placed before the absorber. In this case only a small spot of the vibrated absorber is observed. We found for SS foil that nuclei, exposed to γ radiation in this small spot, vibrate with almost the same amplitudes whose difference does not exceed a few picometers within the irradiated area.

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