Influence of effective thickness in elastic anisotropy and surface acoustic wave propagation in CoFeB/Au multilayer

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Abstract

Surface acoustic waves (SAWs) in magnetic multilayered nanostructures are key to understanding nanoscale material behavior, with important implications for acoustic and spintronic technologies. This study investigates how the thickness of the magnetic CoFeB layer affects SAW propagation in CoFeB-based multilayers. Two effective medium approaches are considered: one treating the multilayer as a homogeneous medium and another focusing on the light penetration region. Elastic properties are analyzed using Brillouin light scattering and numerical modeling, emphasizing the anisotropy of Young's modulus and its dependence on CoFeB thickness. The results show pronounced changes in SAW velocity and elastic anisotropy with varying multilayer configurations, highlighting the role of penetration depth in effective medium approximations. These findings provide insights into tuning acoustic and spin-wave frequencies through structural design, supporting the development of advanced resonators, SAW filters, and spin-wave-based information processing devices.

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