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Electromagnetic-Resonance-Ultrasound Microscopy with Isolated Langasite Oscillator for Measuring Local Elastic Constants of Multi-Phase Solids

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We developed a new acoustic-resonance microscopy, electromagnetic-resonance-ultrasound microscopy (ERUM), to map a material's elastic constant in a local surface region. It is based on the resonance-frequency shift of a langasite ($La_3Ga_5SiO_{14}$) crystal excited by an electric field from a surrounding solenoid coil: no electrodes were used. The acoustic coupling is made only at the tip of the crystal touching the specimen surface. Analysis on the dynamic contact stiffness with the Rayleigh–Ritz method deduced the local elastic constant from the resonance frequency. As an illustrating example, Young's modulus distribution of a duplex stainless steel is presented, which shows good agreement with the existing study.

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