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Accession Number

12394571

Author

Yu-Chieh Wen. Shi-Hao Guol. Hung-Pin Chen. Jinn-Kong Sheu. Chi-Kuang Sun.

Author/Editor Affiliation

Yu-Chieh Wen. Shi-Hao Guol. Hung-Pin Chen. Chi-Kuang Sun. : Department of Electrical Engineering, National Taiwan University, Taipei 10617, Taiwan

Jinn-Kong Sheu. : Institute of Electro-Optical Science and Engineering, Advanced Optoelectronic Technology Center, National Cheng Kung University, Tainan 70101, Taiwan

Title

Femtosecond ultrasonic spectroscopy using a piezoelectric nanolayer: Hypersound attenuation in vitreous silica films

Source

Applied Physics Letters, vol.99, no.5, 1 Aug. 2011, 051913 (3 pp.). Publisher: American Institute of Physics, USA.

Abstract

We report ultra-broadband ultrasonic spectroscopy with an impedance-matched piezoelectric nanolayer, which enables optical generation and detection of a 730-fs acoustic pulse (the width of ten lattice constants). The bandwidth improvement facilitates THz laser ultrasonics to bridge the spectral gap between inelastic light and x-ray scatterings (0.1-1 THz) in the studies of lattice dynamics. As a demonstration, this method is applied to measure sound attenuation in a vitreous SiO₂ thin film. Our results extend the existing low-frequency data obtained by ultrasonic-based and light scattering methods and also show a f² behavior for frequencies f up to 650 GHz. (16 References).