Pulse-echo technique for angular dependent magnetoacoustic studies

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We demonstrate the capabilities of a recent improvement of the pulse-echo ultrasonic technique allowing the investigation of anisotropy in magnetoacoustic phenomena while the orientation of a sample is continuously changed with respect to the magnetic field. This is the only method to investigate the tensor of the so called area coefficient, which describes the strain influence on the Fermi surface of the material. The technique has been tested on the layered superconductor Sr_2RuO_4 at temperatures down to 45 mK and in fields of up to 18 T. The longitudinal sound wave propagated in the (100) direction, which coincided with the axis of rotation and was always perpendicular to the field direction. We scanned the orientation of the field in the *bc*-plane of the crystal and performed field and temperature sweeps at specific pioints selected with a precision of about 1°. The observed quantum oscillations were the strongest at small angles between the field and the *c* direction of the crystal. The three frequencies of quantum oscillations (F_α = 3.02 kT, F_β = 12.74 kT and F_γ = 18.44 kT) as well as two values of effective masses (m_α = 3.2 and m_β = 5.5) associated with the α, β, and γ sheets of the Fermi surface measured at zero angle, are in good agreement with the known values[1]. As expected for the cylindrical Fermi surfaces, the frequencies followed the $1/cos\phi$ law. These results demonstrate high performance of the developed technique.

[1]Bergemann, C., et al., Adv. Phys., 52, 639-725 (2003).

Sorting category: Ec Materials, techniques, and applications

Keywords: magnetoacoustic phenomenon, quantum oscillations, superconductivity, ultrasonic measurements

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