AK 2 Hochfrequenzakustik - akustische Oberflächenwellen (Sitzungsorganisation: Eduard Chilla, Teltow)

Zeit: Freitag 14:30–15:45 Raum: TU EB222

AK 2.1 Fr 14:30 TU EB222

Surface and plate waves in the piezoelectric systems with random rough boundaries — •A.V. Osetrov[1] and E. Chilla[2] — [1]St. Petersburg State Electrotechnical University,Prof. Popov 5, 197376 St. Petersburg, Russia — [2]Vectron International, Tele Filter GmbH, Potsdamer Str. 18, D-14513 Teltow, Germany

Theoretical and numerical solution was proposed for finding of surface and plate waves in piezoelectric half-infinite as well as and finite planar systems with random rough boundaries. No restrictions are introduced for the system material, hence arbitrary crystal class, cut of material, and direction of wave propagation can be investigated. The way of solution is well known transfer matrix approach, which was extended for the random rough boundary. Mechanical boundary conditions are free or clamped boundary, electrical boundary conditions are open or shorted boundary. Theoretical consideration of wave propagation with rough boundary was made in a frame of Rayleigh hypothesis. Statistical properties of boundary are described by the space correlation function, ensemble expectation of roughness is supposed to be equal zero. Ensemble expectation of solution can be done analytically and results in integrals over waves with different wave numbers. Boundary roughness results in appearance of damping for the major wave with existence of spurious bulk, surface and plate waves. Moreover additional waves can exist in such systems.

AK 2.2 Fr 14:45 TU EB222

Confinement of surface acoustic waves in AlN/GaN/γ-LiAlO2 acoustic wells — •Y. Takagaki[1], E. Chilla[2], and K. H. Ploog[1] — [1]Paul-Drude-Institut für Festkörperelektronik, Hausvogteiplatz 5-7, 10117 Berlin, Germany — [2]Vectron International, Tele Filter GmbH, Potsdamer Str. 18, D-14513 Teltow, Germany

We numerically investigate the characteristics of surface acoustic waves (SAWs) in AlN/GaN/γ-LiAlO2 heterostructures. The large difference of the sound velocities in AlN and GaN leads to an expulsion of SAWs from the top AlN layer and their resultant relocation to the middle GaN layer in the short wavelength regime. The SAW velocity in the limit of zero wavelength is given by a bulk sound velocity of GaN, owing to the capping by the AlN barrier layer. The extra confinement of the SAW power in the acoustic well is advantageous in manipulating the operation of GaN-based devices by SAWs. The threshold velocity for the appearance of guided Rayleigh-like modes is found to be smaller than the bulk transverse sound velocity in the substrate. The present system provides furthermore unusual behaviour of SAWs.

Hauptvortrag

AK 2.3 Fr 15:00 TU EB222

Interface acoustic waves in piezoelectric crystals — •Alexander Darinskii[1] and Manfred Weihnacht[2] — [1]Institute of Crystallography, Russian Academy of Sciences, Leninskii pr. 59, Moscow 119333, Russia — [2]Leibniz Institute for Solid State and Materials Research Dresden, P.O. 270016, D-01171 Dresden, Germany

A theoretical study has been made of interface acoustic waves (IAW) propagating in piezoelectric structures of arbitrary symmetry. The interfaces of four types have been considered. 1) Infinitesimally thin metallic layer inserted into homogeneous piezoelectric crystal of arbitrary symmetry. 2) Rigidly bonded crystals whose piezoelectric moduli differ by sign while the other material constants are identical. 3) Perfect sliding contact between identical media. 4) Dielectric gap between two identical piezoelectric. IAWs do not exist obligatory in these structures. We prove the theorems concerning the permissible number and existence conditions for purely localized (non-leaky) and leaky IAWs. We have also analyzed specific resonance singularities of the reflection coefficients for bulk waves; these singularities appear for the angles of incidence corresponding to the excitation of leaky IAW. The conditions for the occurrence of the resonance total reflection have been established. The numerical computations for LiNbO3 and LiTaO3 illustrate general conclusions.

AK 2.4 Fr 15:30 TU EB222

Acoustic waves measurements on SNGS crystals and determination of material constants — •E. Chilla[1], R. Kunze[2], M. Weihnacht[2], J. Bohm[3], R.B. Heimann[4], M. Hengst[4], and U. Straube[5] — [1]Vectron International, Tele Filter, Teltow, Germany — [2]Leibniz Institute for Solid State and Materials Research, Dresden, Germany — [3]Institute for Crystal Growth, Berlin, Germany — [4]Department of Mineralogy, Technische Universität Bergakademie Freiberg, Freiberg, Germany — [5]Department of Physics, Martin-Luther-University, Halle, Germany

We have determined the material parameters of SNGS ($Sr_3NbGa_3Si_2O_{14}$). The elastic material constants were derived from bulk acoustic wave (BAW) measurements and surface acoustic wave (SAW) measurements. Starting with the elastic tensor determined from BAWs we optimized the data set by investigating the influence of the elastic tensor components on the angular dispersion of SAW. The electromechanical coupling coefficient was derived from SAW measurement on open and short-circuited Y-cut. Additionally we measured dielectric parameters.