平成 29 年 4 月 17 日

応用物理学会北海道支部
会員各位

応用物理学会北海道支部

講演会のお知らせ

下記講演会を開催いたしますので、多数ご参加下さいますようご案内
申し上げます。

演題：Nanoscale Imaging with Laser Ultrasonics
講師：Vitalyi Gusev 氏
（LAUM UMR-CNRS 6613, Universite du Maine, Professor）
日時：平成 29 年 5 月 1 日（月） 16:30～17:30
場所：北海道大学工学部物理工学系大会議室 （A1-17）
主催：応用物理学会北海道支部

講演の要旨

In picosecond laser ultrasonics laser pulses of femtoseconds -- picoseconds duration are used both for the generation and detection of the acoustic pulses with a typical length from 100 nm down to several nanometres. These acoustic pulses could be applied for the depth profiling, i.e., in-depth spatially resolved imaging, of the inhomogeneous materials.

In the optically transparent media picosecond acoustic interferometry, also called time-domain Brillouin scattering technique, monitors temporal evolution of a single frequency component of wide-frequency-band acoustic pulses, providing opportunity for the depth-profiling of the acoustic velocity variations in the inhomogeneous materials. In an inhomogeneous medium, the time-domain Brillouin scattering signal at each time instance contains information on the local parameters of the medium in the spatial position of the laser-generated light-scattering acoustic pulse at this time instance. Theoretical analysis indicates that depth-profiling could be achieved with sub-μm to nm spatial resolution. The spatial resolution of the technique can be controlled either by the characteristic spatial scale of the linear laser-generated picosecond acoustic pulse propagating inside the tested material or the spatial width of the weak shock front in the nonlinear acoustic pulse. The theory proposes how the technique could be improved for the simultaneous depth-profiling of not only acoustical, but also optical and acousto-optical parameters of the spatially inhomogeneous materials [1]. In the case of the propagation of the nonlinear acoustic pulses in homogeneous media the theory explains how the velocities of weak shock fronts and the nonlinear parameter of the medium can be obtained [2].

The theory is illustrated by some examples of recent experiments on in-depth imaging of sub-μm thick nano-porous coatings [3,4], two-dimensional imaging of poly-crystalline materials at high pressure in diamond anvil cell [5,6], and of transformation of nonlinear acoustic pulses in glass-forming liquid [7].

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[6] M. Kuriakose, et al., Ultrasonics 69, 201 (2016)
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