PHASE TRANSITION DYNAMICS STUDIED BY COHERENT PHONON EXCITATION WITH ULTRASHORT LASER PULSES

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The low-frequency spectroscopy is very important for the study of the phase transition dynamics, for example, it is very adequate to detect soft-mode spectra near the structural phase transition point by Raman scattering spectroscopy. However, the spectroscopic method always encounters experimentally a difficulty near the phase transition point due to the overlapping between the soft mode spectra and the strong elastic-scattering component caused from surface and/or imperfections of the sample crystal. A new time-resolved phonon spectroscopy, *the coherent phonon excitation method*, has been attracted a lot of attention of many researchers because of its advantage to observe the time dependent behavior of phonons excited artificially with the selected wave vector [1, 2]. Two coherent ultrashort laser pulses overlap each other to generate an interference pattern where the strong electric field acts as a force to drive a phonon mode. The probe process gives the motion of phonons in the time domain adequate for the slow dynamics.

Several examples of the recent studies are given in the following. (1) Acoustic phonon excitation; The polarization relaxation time of the ferroelectric TGS was determined precisely [3]. The acoustic phonon excitation in a sub-GHz region was also done in NH_4Cl. The surface mode of the thin film is also good target of the present method [4]. (2) Optic phonon excitation; The soft B_2 ferroelectric mode of KDP is excited directly as a function of temperature near the transition point [5]. The very early stage of the time dependence of the soft B_2 mode has been observed over the limit of the Debye model. (3) Phonon- polariton excitation; The precise dispersion relation of the phonon-polariton has been given in the time domain by a new optical-heterodyne detection system with optical phase masks [6].

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