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Neutron scattering study of phonon dynamics on $SrGa_{16}Ge_{30}$

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Large vibration of an atom in an oversized atomic cage, so called rattling, has attracted a great interest since it can be the origin of some exotic physical properties. For example, the rattling can be responsible for an extremely low thermal conductivity. Electronic properties could also be affected via electron-phonon coupling. To clarify the relation between the rattling motion and exotic physical properties in materials having oversize atomic cages, it is very important to understand the nature of the rattling.

$SrGa_{16}Ge_{30}$ is one of compounds that has large Ga and Ge atomic cages filled with Sr atoms. In the compounds, the Sr atoms are considered to behave as rattlers in the oversized atomic cages. To clarify the vibrational motion of filling atoms, we have conducted neutron scattering measurements on $SrGa_{16}Ge_{30}$ compounds using the 3-axis spectrometers, GPTAS and AKANE, at JRR-3M reactor of Japan Atomic Energy Agency in Tokai. Fig. 1 shows the phonon dispersion of $SrGa_{16}Ge_{30}$ below $E = 12$ meV with propagation vector of [100]. The optical phonon mode observed at $E = 4$ meV corresponds to a guest mode, in which Sr atoms vibrate largely. The guest mode show anti-crossing behavior with the acoustic phonon mode, indicating strong interaction between them. Details will be discussed in the conference.

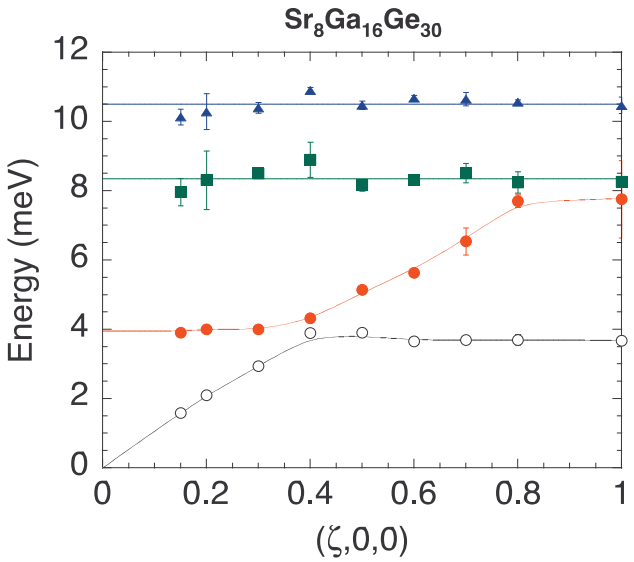

Figure 1: Phonon dispersion curves of the transverse modes with propagation vector [100] in $SrGa_{16}Ge_{30}$. The solid lines are guide to the eye.