

	承認日 Date of Approval: 2014/1/18 承認者 Approver: Ryoichi Kajimoto 提出日 Date of Report: 2014/1/18
実験課題番号 Project No. 2013P0901 実験課題名 Title of experiment Project research on protonic, superionic and amorphous functional materials using 4SEASONS 実験責任者名 Name of principal investigator Mitsutaka Nakamura 所属 Affiliation J-PARC Center	装置責任者 Name of Instrument scientist Ryoichi Kajimoto 装置名 Name of Instrument/(BL No.) 4SEASONS (BL01) 利用期間 Dates of experiments 2014/2/21 11:00 – 2014 2/24 11:00

<p>1. 研究成果概要(試料の名称、組成、物理的・化学的性状を明記するとともに、実験方法、利用の結果得られた主なデータ、考察、結論、図表等を記述してください。</p> <p>Outline of experimental results (experimental method and results should be reported including sample information such as composition, physical and/or chemical characteristics.</p>
<p><u>Sample Information</u></p> <p>Name: Sodium Iodide Chemical Formula: NaI Form of shape: Powder (wrapped in an Al foil with cylindrical shape) Quantity: 15.8g Physical/Chemical characteristics: Deliquesce in moist air</p> <p><u>Experimental Method</u></p> <p>Fermi chopper conditions: f=250Hz, delay= 2033.45us Incident Energies: 13.56, 21.03, 36.94, 81.28, 304.2 meV (Multi-Ei technique) Temperature: 15K < T < 545K</p> <p><u>Results</u></p> <p>More recently, the inelastic neutron scattering (INS) study on NaI crystals indicated the appearance of intrinsic localized modes (ILM) (M. E. Manley <i>et al.</i>, PRB 79 (2009) 134304), and the other INS study reported with no evidence for ILM in NaI crystals (M. Kempa <i>et al.</i>, PRB 89 (2014) 054308). The ILM is highly localized in space, and the necessary conditions required for the appearance of ILM are considered to be a lattice anharmonicity and a phononic band gap between the acoustic and optic branches.</p> <p>In this study, we investigated the temperature dependence of INS for polycrystalline NaI powder sample. We used a top-loading cryostat with high-temperature sample stick. The two-dimensional maps of a dynamical structure factor $S(Q,E)$ of NaI powder are shown in Figs.1(a) and (b). The peak intensity of TO phonon at around 15 meV is found to be drastically decreasing with increasing temperatures.</p>

1. 研究成果概要(つづき) Outline of experimental results (continued).

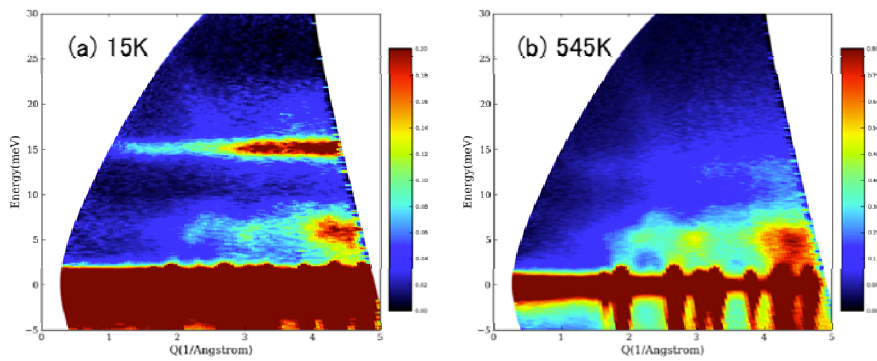


Fig.1: The $S(Q,E)$ maps of polycrystalline NaI powder sample for (a) $T=15$ K and (b) $T=545$ K.

Figure 2 shows the temperature dependences of constant Q slice along $Q=3.6\text{\AA}^{-1}$. These spectra were obtained by subtracting each of background intensity and correcting the Bose population factors. The temperature dependence of TO phonon at 15 meV does not obey the Bose population factor, which means the strong anharmonicity. The phononic band gap was also filled due to the broadening of TO phonon band with increasing temperatures.

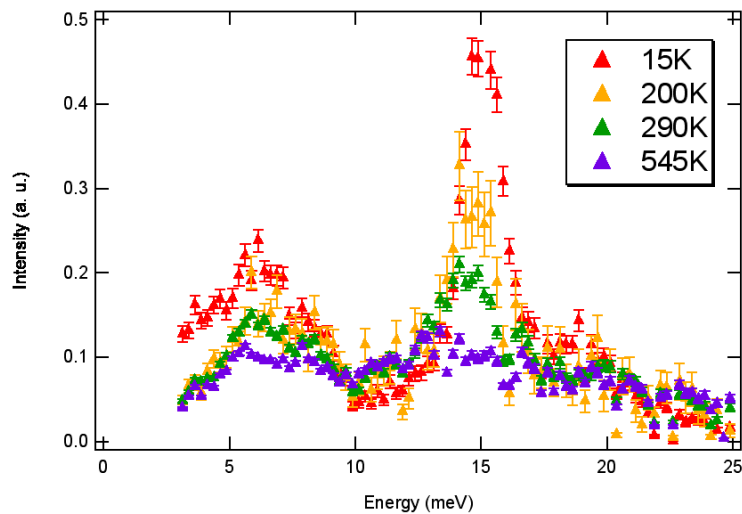


Fig.2: Temperature dependences of constant Q slices of $S(Q,E)$ maps along $Q=3.6\text{\AA}^{-1}$.

We could not obtain the evidence of ILM at this stage, however, the $G(r,t)$ analysis will be able to provide the conclusive evidence of ILM. We are planning to perform further analysis.

必要に応じて、A4 サイズの用紙に続きを記入して下さい。

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