Anisotropic Behavior of Thermal Conductivity in the Bose-Einstein Condensed State of the Bond-Alternating Spin-Chain System $Pb_2V_3O_9$

T. Kawamata[a], M. Sato[a], K. Naruse[a], K. Kudo[b], N. Kobayashi[c], and Y. Koike[a]

[a]Graduate School of Engineering, Tohoku University, Sendai, Japan
[b]Department of Physics, Faculty of Science, Okayama University, Okayama, Japan
[c]Institute for Materials Research, Tohoku University, Sendai, Japan

We have measured the thermal conductivity along the [101], [10$\bar{1}$] and b^* directions, $\kappa_{[101]}$, $\kappa_{[10\bar{1}]}$ and κ_{b^*}, respectively, of $Pb_2V_3O_9$ single crystals in magnetic fields parallel and perpendicular to the heat current, to investigate the origin of the enhancement of the thermal conductivity in the state of Bose-Einstein condensation (BEC) of magnetic excitations, namely, triplons. By the application of magnetic field along to the [101] direction, $H_{[101]}$, parallel to the spin-chains, it has been found that $\kappa_{[101]}$ is markedly enhanced but neither $\kappa_{[10\bar{1}]}$ nor κ_{b^*} in the BEC state with increasing field at 3 K. It is concluded that the enhancement of $\kappa_{[101]}$ in the BEC state by the application of $H_{[101]}$ is caused by the enhancement of the thermal conductivity due to triplons, because the magnetic interaction along the [101] direction is the strongest in the crystal. By the application of magnetic field along to the [10$\bar{1}$] and b^* directions perpendicular to the spin-chains, on the other hand, no enhancement of $\kappa_{[101]}$ in the BEC state is observed. These results indicate that the BEC state is strongly developed by the application of $H_{[101]}$, where rotational invariance necessary for the conservation of the number of triplons is kept up.[1]

[1]T. Nikuni, M. Oshikawa, A. Oosawa and H. Tanaka: Phys. Rev. Lett. **84** (2000) 5868.