Pressure-temperature phase diagram for orbital and spin states in $RVO_3 (R=Y, Tb)$ DAISUKE BIZEN, KEISUKE NAKATSUKA, TETSUYA MURATA, HIRONORI NAKAO, KAZUAKI IWASA, YOUICHI MURAKAMI, Tohoku University, TOYOTAKA OSAKABE, JAEA, SHIGEKI MIYASAKA, Osaka University, YOSHINORI TOKURA, University of Tokyo, CERC-AIST — Perovskite-type vanadium oxides $RVO_3 (R=Y, La-Lu)$ show various physical properties coupled with the orbital and spin states. Orbitally ordered states of $V 3d^2$ in YVO$_3$ have been systematically investigated by X-ray scattering technique under high-pressure and low-temperature (HP-LT). The pressure-temperature phase diagram for the orbital state was clearly determined from the crystal parameters, i.e. the lattice constants and the reflection conditions. It indicates that the $C$-type orbital ordering ($C$-OO) is stabilized as compared with the $G$-type orbital ordering ($G$-OO) by applying hydrostatic pressure. Based on the result, we succeeded in controlling the ground state of $3d$-orbital in TbVO$_3$ from $G$-OO to $C$-OO by applying pressure. The spin state coupled with the orbital was also studied by neutron scattering under HP-LT. It elucidated that the magnetic ground state changed from the $C$-type spin ordering to the $G$-type one. This result indicates the strong coupling between orbital and spin states.

Daisuke Bizen
Tohoku University

Date submitted: 24 Nov 2007

Electronic form version 1.4