^{31}P, $^{65,63}Cu$ NMR AND MAGNETIC SUSCEPTIBILITY STUDY OF ISOSTRUCTURAL COMPOUNDS $A(BO)Cu_4(PO_4)_4$ (AB = PTi, SrTi, KNb)

Riho Rästa[1*], Ivo Heinmaa[1], Kenta Kimura[2], Tsuyoshi Kimura[2], Raivo Stern[1]

[1] *National Institute of Chemical Physics and Biophysics, Akadeemia tee 23, 12618 Tallinn, Estonia*
[2] *Department of Advanced Material Science, University of Tokyo, Kashiwa, Chiba 277-8561, Japan*
*e-mail: riho.rasta@kbfi.ee

Magnetic environments of the tetragonal compounds $A(BO)Cu_4(PO_4)_4$, with (AB = PTi, SrTi, KNb) are investigated with ^{31}P, ^{65,63}Cu nuclear magnetic resonance (NMR) techniques. The compounds exhibit a phase transition at temperatures below $T_N = 10\,K$ (Fig. 1), where symmetry-based phenomena, like the magnetoelectric (ME) effect, are easy to arise. The ^{31}P magnetic shift K of PTCPO [1] shows a clear splitting at the Néel temperature $T_N = 6.8\,K$, where the resonance lines brake into two in case of the external magnetic field B along the *b*- or *c*-axis. A phase diagram of magnetic susceptibility $\chi(T)$ at different magnetic fields were measured. The relation of K vs χ yielded hyperfine field values $H_{hf}^{c} = 6.77\,kOe/\mu_B$ for $B||c$ and $H_{hf}^{b} = 6.19\,kOe/\mu_B$ with $B||b$. KNbCPO is the first of the compounds that have the B element switched. This changes the material into non-magnetic. The Knight shift and susceptibility show a broad maximum around $T_m = 30\,K$ and surprisingly the compound still exhibits a shift at the Néel temperature $T_N = 6.8\,K$. Below $T_N = 6.2\,K$ PTCPO splits into two different resonance lines, which indicate a phase transition into a magnetically ordered state, where as KNbCPO exhibits only a change from decreasing shift into increasing. From the ^{65,63}Cu zero field NMR measurements we saw that the local magnetic fields in the magnetic Cu^{2+} ions of SrTCPO and PTCPO were $B_{\text{loc}} = 14.51$ T and $B_{\text{loc}} = 14.90$ T respectively. The ^{31}P NMR with rotating single crystal were performed for PTCPO at room temperature and in the ordered state region at $T_N = 4.2\,K$. A clear difference is observed from the magnetic fields in BTCPO [2].

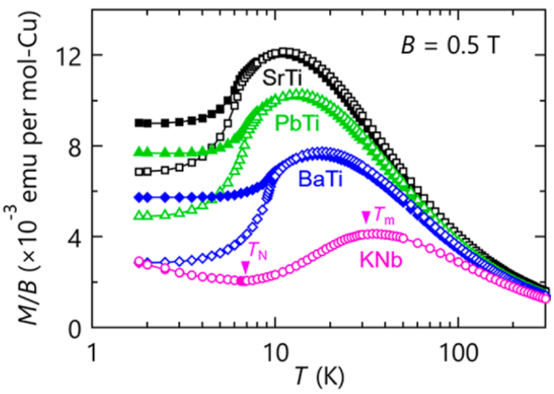

Fig. 1 Temperature dependance of magnetic susceptibility in ABCPO [1]

References

1. K.Kimura, S.Kimura, T.Kimura, 2019, *J. Phys. Soc. Jpn. 62, 772.*
2. T.Hayashida, K.Kimura, D.Urushihara, 2021, *J. Am. Chem. Soc., 143, 3638−3646.*

Euroopa Liit
Euroopa
Regionaalarengu Fond

Eesti
tuleviku heaks