Thermal Conductivity Measurement as a Probe to Determine the Structural Transition of FeV_2O_4

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Introduction

The study of thermal conductivity can determine the structural transition of the crystal. The thermal conductivity of polycrystalline sample FeV_2O_4 was measured by using home made sample holder. We found that there are some structural transitions in the crystal structure from the cubic system to the tetragonal and then to orthorhombic phases.

Experimental

We are developing a thermal conductivity sample holder that can be used to measure thermal conductivity in steady state method. We mount the sample (FeV_2O_4) on a hand made sample holder. We connected the sample with a 1 mm diameter constantan wire as a reference. Two thermocouple wires (chromel constantan chromel) were used to measure the temperature difference in the sample and in the reference. We put the sample into a cryostat and pumped the air and measured the thermal conductivity of the sample in liquid nitrogen.

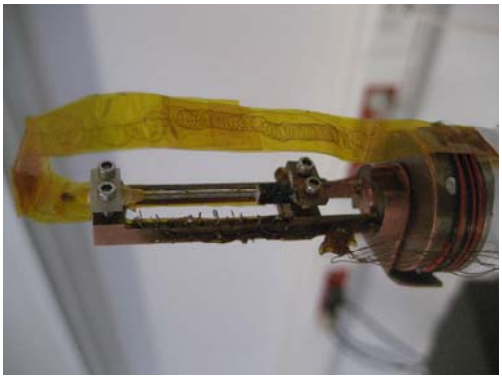

Fig.1 The Thermal conductivity sample holder

Results and Discussion

In order to check for reproducibility, we took the experimental data manually and automatically by using Lab View program. The data look similar except the difference in the high temperature regime. However, we observed two phase transitions in the sample at 135 K and 110 K as the crystal structure changed from cubic to tetragonal and finally to orthorhombic structure as suggested in the paper by Katsufuji et al.[1]. In the future we would like to do the measurement under a magnetic field.

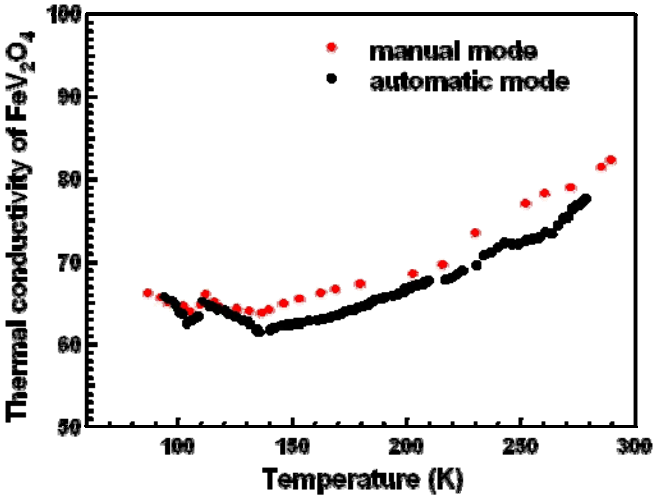

Fig.2 The thermal conductivity of FeV_2O_4vs temperature

Conclusions

The thermal conductivity measurement can be used in order to probe structural transitions. We now plan to extend this technique to high magnetic fields.

Acknowledgements

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References

[1] T. Katsufuji *et al*., Journal of the Physical Society of Japan, **77**, 0537081 (2008).