

# Tuning the phase transition temperature of FeRh thin films by doping copper impurities

Jui-Chi Chung (鍾睿騏), Aswin kumar Anbalagan\* (阿什溫), Chen-Lin Fan (范振琳), Yu-Hao Liao (廖育豪) and Chih-Hao Lee (李志浩)

Department of Engineering and System Science, National Tsing Hua University, Hsinchu, Taiwan, 30013

## Abstract

FeRh alloys with B2 (CsCl) structure shows fascinating first order magnetic transition from the antiferromagnetic (AFM) to ferromagnetic (FM) states at around 370 K upon heating from room temperature. In this work, we aimed in tuning the transition temperature of FeRh thin films by doping copper impurities of 2-5% into it. To achieve this, thin epitaxial films FeRh were prepared onto MgO (001) substrate and then doping 2-5% of copper atoms into the FeRh films by DC magnetron co-sputtering method. It has been observed clearly from the magnetic optical Kerr effect and vibrating sample magnetometer results that,  $T_{\text{FM-AFM}}$  can be reduced by more than 100 K after doping copper atoms. Since the atom size of Cu is very similar to Fe atom, this drastic AFM-FM temperature change is not mainly caused by the strain created in the samples due to copper concentration. Rather it might have occurred because of the variations in the valence electrons concentration. However, the change in phase transition temperature drop did not follow the linearity with respect to the valence electron concentration. In addition, this work suggests us that shortening the long range order of AFM may play a crucial role in reducing the phase transition temperature of FeRh films with respect to the copper doping.

**Keywords:** FeRh alloy, MOKE, doping, VSM, phase transition.