

# **SEMINAR ON MAGNETISM AND SUPERCONDUCTIVITY**

We kindly inform You that on **Wednesday**

**March 6<sup>th</sup> at 10:00**

there will be a **seminar in room 203, building I**

where

**MSc. Takayuki Hojo**

*(Department of Applied Physics, Graduate School of Engineering, Tohoku University, Sendai,  
Miyagi 980-8579, Japan)*

will deliver a lecture on:

**“Half-metallic  $\text{Co}_2\text{FeAl}_x\text{Si}_{1-x}$  thin films with a small magneto-crystalline anisotropy  $K_1$  for highly sensitive tunnel magnetoresistance sensor application”**

A tunnel magnetoresistance (TMR) sensor based on magnetic tunnel junctions (MTJs) is a highly sensitive magnetic sensor workable at room temperature. Due to the dramatic increase in sensitivity achieved in recent years, the developed TMR sensors have succeeded in measuring a bio-magnetic fields. The sensitivity of TMR sensors is determined from the slope of the magnetoresistance curve around zero magnetic field, thus both high TMR ratio and small magneto-crystalline anisotropy are required. In order to improve the sensitivity of TMR sensors, we have focused on Co-based Heusler alloy  $\text{Co}_2\text{FeAl}_x\text{Si}_{1-x}$  as a free layer in TMR sensor. This is because MTJs with  $\text{Co}_2\text{FeAl}_x\text{Si}_{1-x}$  electrode is promising for gaining a high TMR ratio due to its half-metallicity. On the other hand, their magneto-crystalline anisotropy has not been investigated so far. In this study, we have fabricated monocrystalline Co-based Heusler alloy  $\text{Co}_2\text{FeAl}_x\text{Si}_{1-x}$  thin films by co-sputtering method. Systematic investigation of their atomic ordering and magneto-crystalline anisotropy  $K_1$  as a function of the Al component  $x$  was performed. Thickness of studied layers was kept constant as 50 nm. Magneto-crystalline anisotropy constant  $K_1$  changed from positive to negative with increase of  $x$ , and it was almost zero around  $x = 0.33$ . At the same time for this composition, B2 ordering parameter was 0.7 and  $L2_1$  ordering parameter was 0.3. These results are indicating that  $\text{Co}_2\text{FeAl}_x\text{Si}_{1-x}$  thin film with around  $x = 0.33$  possesses both half-metallicity and small magneto-crystalline anisotropy  $K_1$  so it can be ideal candidate to be used as a free layer in highly sensitive TMR sensors.

**The seminar will be given in English on-site in room 203, though the ZOOM transmission will be available - link is provided on the IP PAS website.**

**We sincerely invite You**

**Roman Puźniak / Andrzej Szewczyk / Henryk Szymczak**