EC03

Electronic and Magnetic Structure of Fe/W(100)

Hangil Lee[1], J. Y. Lee[2], B. G. Park[3], S. Kim[2], C. C. Hwang[1], J. -Y. Kim[1], J. -H. Park[3], and Chanyong Hwang[4]*

[1]Beamline Research Division, Pohang Accelerator Laboratory, POSTECH, Pohang, Korea
[2]Department of Chemistry and School of Molecular Science, Korea Advanced Institute of Science and Technology, Daejeon, Korea
[3]Department of Physics, POSTECH, Pohang, Korea
[4]Division of Advanced Technology, Korea Research Institute of Standards and Science, Daejeon, Korea

*Corresponding author: cyhwang@kriss.re.kr, Phone: +82 42 868 5392, Fax: +82 42 868

Despite the large lattice mismatch between Fe and W, ultrathin Fe films have been found to grow pseudomorphically on W(100) [1] and W(110) [2] substrates. This offers opportunities to study the effects of both a larger lattice strain and a stronger interfacial interaction on thin film magnetism. Electronic and magnetic properties of ultrathin Fe films grown on W(100) substrate at 298 and 400 K as a function of film thickness (1.0~4.0 ML) have been characterized using angle-resolved photoemission spectroscopy (ARPES), MCD (magnetic circular dichroism). We have found the change of growth mode dependent on the substrate temperature (298 K and 400 K) and a thermally stable layer (1.0 or 2.0 ML) by annealing up to 900 K after Fe deposition at room temperature, which was a controversial issue. We have also compared our band mapping results to the theoretical calculation results for 1 and 2.0 ML Fe/W(100) systems at 400 K, respectively. Moreover, we found a ferromagnetic coverage of this system using MCD.

In this experiment, we extracted three results for this system. First, the growth modes of Fe/W(100) as a function of substrate temperature (at 298 and at 400 K) are shown to be markedly different. where Fe layers are grown in island at 298 K while at 400 K layer-by-layer growth are possible. Second, bilayer (2.0 ML) is the thermally stable layer by annealing effects, where Fe grows on W(100) at 298 K and then is annealed to 900 K (thermally stable temperature region of Fe/W(100) system). Third, ferromagnetic order is found at 2 ML using MCD.

REFERENCES

[1] X.L.Zhou, C.Yoon, and J.M.White, Surf. Sci. 203, 53(1988)
[2] U.Gradmann and G.Waller, Surf.Sci. 116, 539(1982)

EC04

Magnetoresistance Effect in $Co_x(Alq_3)_{1-x}$ Granular Films

Gang Ni[1,3]*, Qi Shu[2], Xiaomeng Zhao[1], Junqi Wu[2], Peng Sheng[1], Jianfang Yin[1], Bin Ma[1], Wei Huang[2] and Youwei Du[3]

[1]Department of Optics Science and Engineering, Fudan University, Shanghai, P.R.China
[2]Laboratory of Advanced Materials, Fudan University, Shanghai, P.R.China
[3]National Laboratory of Solid State Microstructures, Nanjing University, Nanjing, Jiangsu, P.R.China

*Corresponding author: gni@fudan.edu.cn, Phone: +86 21 5566 4180, Fax: +86 21 5566 4192

In recent years, spintronics based on organic semiconductors have attracted growing interest due to the advantage of organic semiconductor(such as inherent lattice flexibility and long spin coherence). GMR effects were found in organic-based spin-valves and organic light-emitting diodes (OLEDs). However, the mechanism is still unclear. In this paper, the transport properties of magnetic metal-organic semiconductor granular films were investigated.

A series of $Co_x(Alq_3)_{1-x}$ granular film samples were prepared using co-evaporating technique. Transmission electron microscopy (TEM) was performed to investigate the microstructure of these samples. TEM images show typical characteristics of granular films with average size in the order of 20 nm. The results measured using a vibrating sample magnetometer (VSM) show a gradual change from superparamagnetism to ferromagnetism as x increases in these samples. Magnetoresistance and resistance of the samples at different temperature were measured using physical properties measurement system (PPMS, Quantum Design, Inc.). In these samples, a transition from positive to negative magnetoresistance effect was observed with the decrease of temperature from 300K to 30K. Typically, in x=44vol% sample, the positive MR value reaches 2.0% at room temperature, while the negative MR value reaches -5.4% at 30K. Moreover, the temperature dependence of resistivity of the samples is also investigated. The Temperature Coefficient of Resistance (TCR) is positive near room temperature, while in low temperature, the resistivity increase drastically with further decrease of temperature.

It is suggested that there are two kind of transport mechanisms in this granular films system. The positive MR results from ordinary magnetoresistance (OMR) effect at room temperature, while at low temperature, the Tunneling magnetoresistance (TMR) effect is dominant due to the drastic increasing of the resistance of Alq_3, which act as tunneling layers between adjacent cobalt granules in the system, leading to the negative MR effect.

REFERENCES

[1] Z.H. Xiong, Di Wu, Z. Valy Vardeny, and Jing Shi, Nature, **427**, 821 (2004).
[2] Ö. Mermer, G. Veeraraghavan,T. L. Francis, Y. Sheng, D. T. Nguyen, M. Wohlgenannt, A. Köhler, M. K. Al-Suti, and M. S. Khan, Physical Review B, **72**, 205202 (2005)