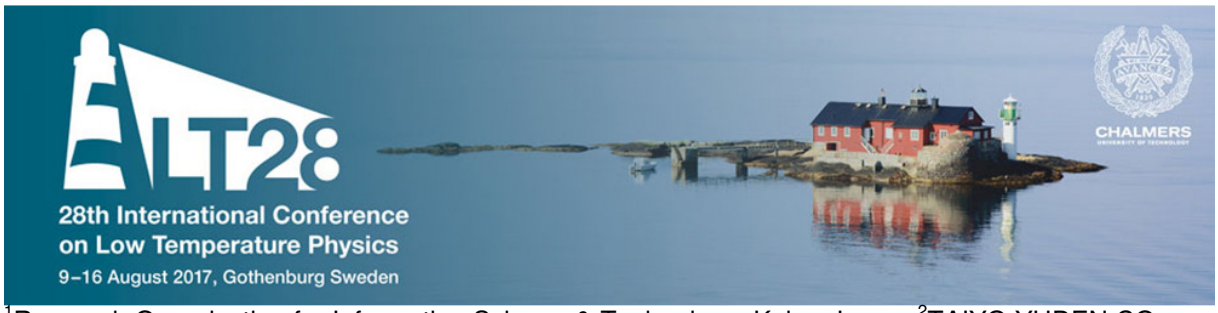


[1]Research Organization for Information Science & Technology, Kobe, Japan, [2]TAIYO YUDEN CO., LTD., Gunma, Japan, [3]Tokyo Tech, Dept. Mater. Sci. Eng., Yokohama, Japan, [4]University of Tokyo, Dept. of Physics, Tokyo, Japan

Titanium dioxide (TiO_2) is a widely used photocatalytic material with many potential application in electronics, optoelectronics, and photovoltaics. The change of the crystal structure by impurity hydrogen (H) and oxygen vacancy (V_O) affects the electronic properties and the activation performance of TiO_2. Therefore, we pay attention to the effect of H doping of TiO_2, and there are excess electrons accompanying H or V_O. It is known that the electrons can localize at Ti 3d orbitals, forming Ti^{3+} ions [1, 2]. The trapped electrons form small polarons that consist of the electrons coupled to the distortion of the lattice around the Ti^{3+} ions. We examine the structure of H in rutile TiO_2 by using density functional theory (DFT) calculation. The spin density for a localized electron in Ti site exists and it is verified that the excess electrons are described as localized small polarons by DFT calculation. We also understand H behavior by calculating the isotropic and anisotropic hyperfine coupling constants. Because muonium in crystals behaves similarly to H, muon spin rotation (μSR) has played an important role in identification of hydrogen-like states in TiO_2. We evaluate the accuracy of DFT calculation for H in TiO_2 by the comparison with hyperfine parameters of μSR [3].

References:

[1] A. Janotti, C. Franchini, J. B. Varley, G. Kresse, and C. G. Van de Walle, Phys. Status Solidi RRL **7**, 199 (2013).
[2] F. Filippone, G. Mattioli, P. Alippi, and A. Amore Bonapasta, Phys. Rev. B **80**, 245203 (2009).
[3] K. Shimomura, R. Kadono, A. Koda, K. Nishiyama, and M. Mihara, Phys. Rev. B **92**, 075203 (2015).

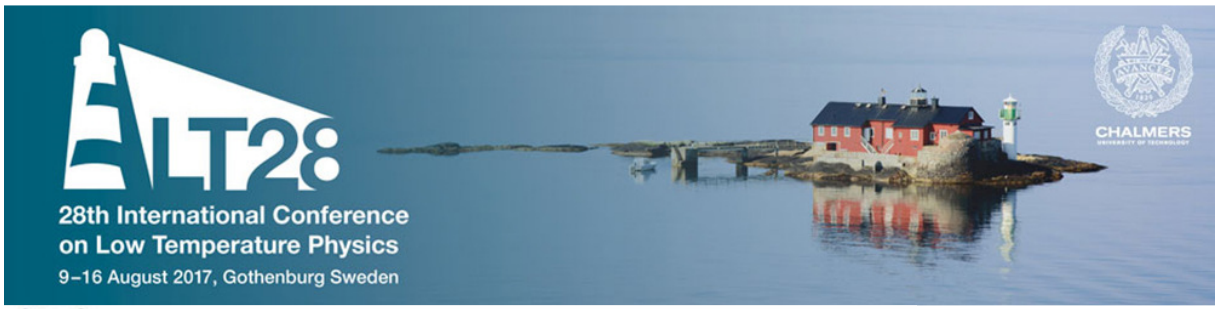
Postersession 1
Thursday, 10 August 2017
16.30-18.30
G Foyer

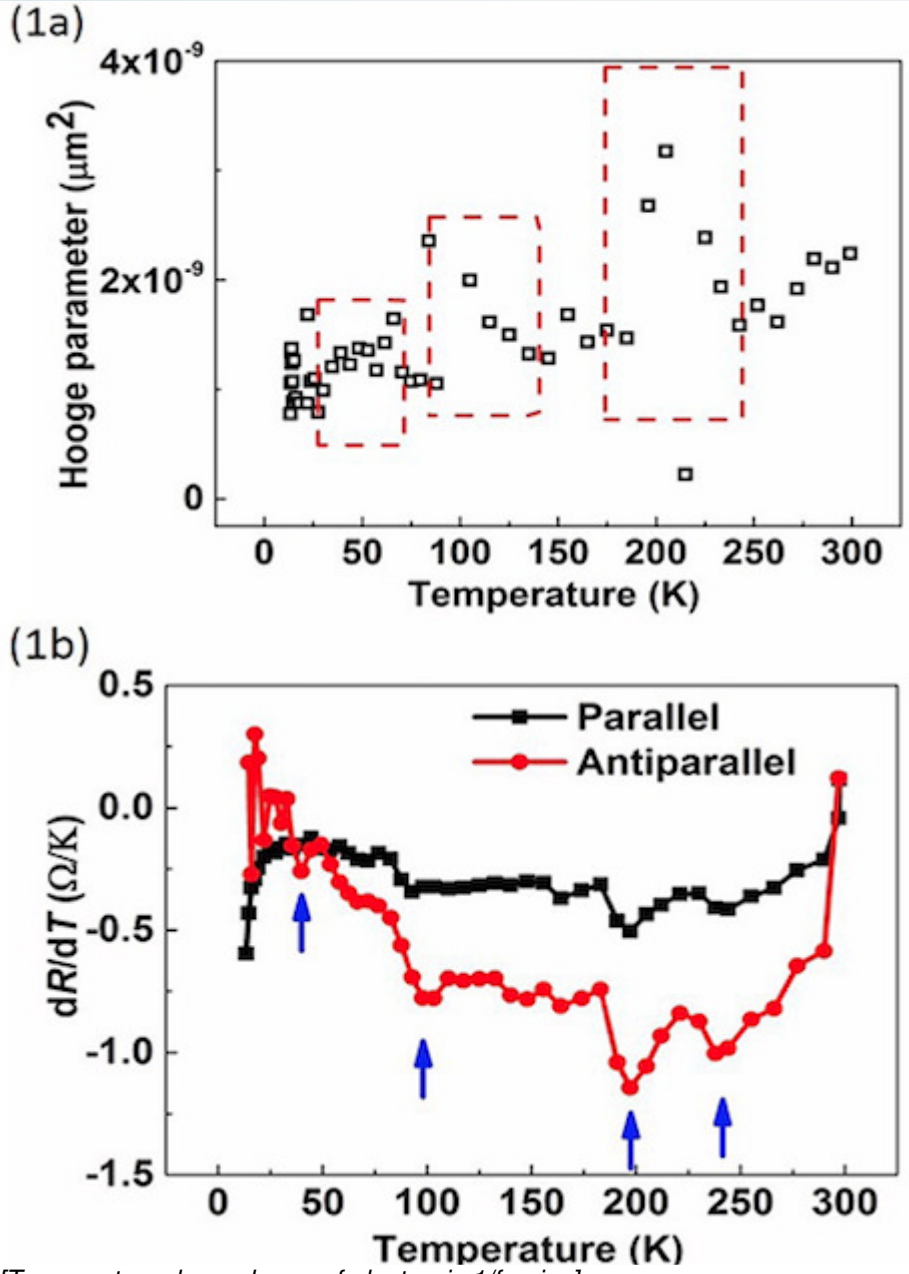
P.472

Enhancement of 1/*f* noise due to thermally-activated trapping-detrapping processes in Magnetic Tunnel Junctions (MTJs)

Zheng C.[1], Shull R.[2], Chen P.J.[2], Pong P.[1]
[1]University of Hong Kong, Hong Kong, Hong Kong, [2]National Institute of Standards and Technology, Gaithersburg, United States

In MTJs, the electronic 1/*f* noise is attributed to the resistance fluctuation that originates from the trapping-detrapping (TD) events during tunneling process [1]. Previous studies have focused on the impact of temperature (T),[2] bias voltage,[3] and magnetization configuration[2] on the electronic 1/*f* noise. However, a more elaborated description of TD mechanism is still lacking. Herein we investigated the T dependence of the electronic 1/*f* noise and several abnormal noise peaks were observed (Fig.1a). These peaks should not arise from the random telegraph noise because no Lorentzian feature was observed.[4] They presumably derive from the activation of extra TD events during the tunneling process, which is evidenced by the observation of the dips in the $dR(T)/dT$ curve (Fig.1b). These TD processes impede the tunneling of electrons and locally increase the resistance (R). As a result, the R fluctuation in MTJs is promoted, enhancing the electronic 1/*f* noise. Since the manifestation of the electronic 1/*f* noise is closely related to the activation energies of TD processes, the observed phenomenon indicates that the distribution of activation energies of the thermally-activated TD processes could be dramatically altered at certain T, leading to the abnormally boosted electronic 1/*f* noise.





[Temperature dependence of electronic 1/f noise]

References:

1. Z.H. Yuan *et al.*, *J. Magn. Magn. Mater.* **398**, 215-219, (2016)
2. L. Jiang *et al.*, *Phys. Rev. B* **69**(5), 054407 (2004)
3. F.G. Aliev *et al.*, *Phys. Rev. Lett.* **112**(21) 216801 (2014)
4. T. Arakawa *et al.*, *Phys. Rev. B* **86**(22) 224423 (2012)

Postersession 1
Thursday, 10 August 2017
16.30-18.30
G Foyer