given in this presentation with results obtained with an ultrastable double aberration-corrected and monochromated electron microscope. First of all, we will demonstrate the detection of low-loss features in plasmonic nanostructures down to the infrared part of the electron energy loss spectrum by directly imaging resonances down to 0.5eV, the lowest features currently detected with EELS [1]. Using momentum resolved near-edge structures we will discuss the detection of the strong anisotropy in bonding in carbon nanotubes. After an overview of the imaging conditions used to detect ordering changes in alloy nanoparticles using a combination of X-ray diffraction techniques and high-angle annular dark-field STEM imaging and simulations, we will discuss the study the application of atomic-resolved EELS mapping in the study of interfaces [2], [3]. We will demonstrate how this powerful technique can be used in the study of the structure and substitutional effects on the atomic structure of interfaces and electronic states changes within one or two unit cells from the interface. We will demonstrate how such spectroscopic technique can be used to detect changes in valence and electronic structure as well as the termination of substrate surfaces in contact with epitaxial films. Examples will show how the stability of microscopes, coupled with atomic resolution, can be used to not only obtain spectroscopic information but aso to determine, directly from high angle annular dark-field images, the local strain at interfaces and at dislocations [4]. Additional examples will highlight the application of microscopy technique to the analysis of clusters, multiferroic materials based on the perovskite structures, and interfaces in complex oxides. These examples demonstrate that compositional and chemical state (valence and coordination) information can be obtained down to the Ångstrom level.

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Keywords: electron energy loss spectroscopy, transmission electron microscopy, imaging

MS.65.5

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Photo-conductivity and electronic structures of Au-nanoparticle embedded silica-nanowires

W. F. Pong,[a] C.-W. Pao,[a] C.-T. Wu,[b] L.-C. Chen,[c] C.-H. Chen,[c] K.-H. Chen,[d] M.-H. Tsai,[e] J.-H. Guo,[f] [a]*Department of Physics, Tamkang University, Tamsui 251, (Taiwan).* [b]*Department of Material Science and Engineering, National Taiwan University, Taipei 106, (Taiwan).* [c]*Center for Condensed Matter Sciences, National Taiwan University, Taipei 106, (Taiwan).* [d]*Institute of Atomic and Molecular Sciences, Academia Sinica, Taipei 106, (Taiwan).* [e]*Department of Physics, National Sun Yat-Sen University, Kaohsiung 804, (Taiwan).* [f]*Advanced Light Source, Lawrence Berkeley National Laboratory, Berkeley, CA 94720, (USA).* E-mail: wfpong@mail.tku.edu.tw

Silica nanowires (SiO_x-NWs) embedded with Au peapods have been studied by energy-filtered scanning transmission electron microscopy (EFTEM), Au L_3- and O K-edge x-ray absorption near-edge structure (XANES) and x-ray emission spectroscopy (XES). XANES and XES data show that band gaps of Au-peapod embedded and pure SiO_x-NWs were 6.8 eV. XANES results indicate illumination induced electron transfer from Au peapod to SiO_x-NWs. Photo-response and EFTEM measurements show that green light has more significant enhancement of photo conductivity than red and blue light due to surface plasmon resonance.

Keywords: xanes, xes, eftem

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Molecular design of multifunctional magnetic materials

Eugenio Coronado, *Instituto de Ciencia Molecular. Universidad de Valencia. (Spain).* E.mail: eugenio.coronado@uv.es

The field of functional molecular materials has seen a very rapid progress since the discovery of a variety of solid-state properties such as conductivity and superconductivity, non-linear optics, and ferromagnetism. One of the most appealing aims in this field is that of creating complex materials exhibiting multifunctional properties. Thus, by a suitable assembly of the starting molecular bricks one can combine in the same material two or more properties that are difficult or impossible to achieve in a conventional inorganic solid. In this lecture I will present some recent examples reported by my group. I will focus in particular in the design of materials with coexistence of magnetism with a second property (superconductivity, molecular switching, chirality, solubility, porosity,…).

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MS.66.2

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Development of molecular materials with electric and/or magnetic functions

Hayao Kobayashi, Biao Zhou, Akiko Kobayashi, *Departament of Chemistry, College of Humanities and Sciences, Nihon University, Sakurajosui, Setagaya-ku, Tokyo 156-8550, (Japan).* E-mail: hayao@chs.nihon-u.ac.jp

We have tried to develop various types of crystalline molecular systems exhibiting novel electronic functions.

About two decads ago, we have prepared the magnetic organic conductors based on π donor molecules (BETS) and typical tetrahadral magnetic monoanions (FeX_4^-, X=Cl, Br) [1]. Since then, various unprecedented organic superconductors, such as the mixed anion system, λ-$BETS_2Ga_{1-x}Fe_xCl_4$ exhibiting successive metal-to-superconducting and superconducting-to-insulating transitions with lowering temperature, antiferromagnetic organic superconductors, κ-$BETS_2FeX_4$ and field-induced organic superconductors, λ-$BETS_2FeCl_4$ and κ-$BETS_2FeBr_4$ were discovered [2]. Although many works have been made on these BETS conductors, there remain many unsolved questions on their electro-magnetic properties. We will present our recent studies on "mysterious ground state" of λ-$BETS_2FeCl_4$, where antiferromagnetically ordered π electrons in BETS layers and paramagnetic 5/2 spins of $FeCl_4^-$ anions coexist below metal-insulator transition temperature (T_{MI}= 8 K) [3]. We have previously reported the pysical properties of BETS conductors with modified λ-type structure, λ'-$BETS_2GaBr_4$ [4]. Similar to λ-type structure, the crystal belongs to triclinic system and contain two-dimensionally arrays of tetradic colums of BETS molecules. However, in contrast to λ-$BETS_2GaCl_4$ with