MRS and E-MRS organize summer school on materials for renewable energy

www.erice-energy-materials.ct.infn.it

The International "Materials for Renewable Energy" School 2014, co-organized by the Materials Research Society (MRS) and the European Materials Research Society (E-MRS), will be held on July 12–18, 2014 in Erice (Sicily, Italy). The aim of the School is to present the state of the art and the future perspectives for materials applied to the generation and storage of renewable and sustainable energy.

The deadline for registration is June 15, 2014.

Lectures will be given by some of the most recognized academic and industrial experts, merging physics, chemistry, and engineering knowledge in several fields. A general overview of the global energy landscape will be presented by discussing also conventional energy sources and next-generation nuclear production. Topics of the School include the global warming issue, conventional and sustainable technologies, solar energy conversion (photovoltaics and thermal), thermoelectric energy conversion, solar fuels, wind energy conversion, fuel cells, storage, and vehicles.

The directors of the course are David Cahen (Weizmann Institute, Israel), David Ginley (NREL, Colorado, USA), John M. Poate (Colorado School of Mines, USA), Abdelilah Slaoui (ICUBE-CNRS, Strasbourg, France), and Antonio Terrasi (University of Catania, Italy). The School is also being supported by the Italian Ministry of Education, University and Scientific Research and by the Sicilian Regional Government. □

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Continuous dynamic analysis: evolution of elastic properties with strain

S. Basu and J.L. Hay, Agilent Technologies;
J.E. Swindeman and W.C. Oliver, Nanomechanics, Inc.

Mechanical strain triggers changes in inherent molecular structure, especially in polymeric and biological materials. Unlike conventional techniques, we demonstrate a novel dynamic mechanical characterization method to study the effect of this structural evolution with strain on elastic properties. During tensile characterization of small diameter fibers, we quantitatively measured the viscoelastic properties as a continuous function of strain. While this approach is useful to characterize the elastic properties of metal micro-wires independent of applied strain, it is extremely important for fundamental understanding of molecular changes and their effect on the viscoelastic properties in materials like polymer fiber and spider silk. DOI: 10.1557/mrc.2013.49

Lithium oxide solution in chloride melts as a medium to prepare $LiCoO_2$ nanoparticles

Vladimir Khokhlov, Dmitriy Modenov, Vasiliy Dokutovich, Viktor Kochedykov, Irina Zakir'yanova, Emma Vovkotrub, and Igor' Beketov, Russian Academy of Sciences

The paper describes a new technique of molten salt synthesis (MSS) that is based on the direct oxidation of halide ions with molecular oxygen in thermally stable halide melts to prepare nanoparticles of complex oxides. Lithium cobaltate ($LiCoO_2$) was chosen as a model compound for testing this method. Synthesis was carried out in LiCl–$CoCl_2$ melts at 600°C and 700°C under dry-air atmosphere. Fourier transform infrared (FTIR) and Raman spectroscopies, X-ray diffraction (XRD), and transmission electron microscopy (TEM) were used to study the products obtained. The route suggested results in the formation of stoichiometric high-temperature (HT) $LiCoO_2$ powders. DOI: 10.1557/mrc.2014.2

A new experimental approach for evaluating the mechanical integrity of interfaces between hard coatings and substrates

Ke Chen, Yang Mu, and W.J. Meng, Louisiana State University

We describe a new protocol for testing coating/substrate interfacial failures through compression loading of micro-pillars containing an inclined interface region, experimentally realized in the TiN/Ti/Si(100) system. Interfacial failures were achieved through direct compression loading in the axial direction, which yielded reproducible failure stresses which exhibited little dependence on pillar diameter. The testing protocol lends itself to high-resolution analysis of failure surfaces, and is conducive to correlating interfacial structure and chemistry with mechanical failures within the coating/substrate interfacial region. DOI: 10.1557/mrc.2014.3

Oxygen vacancy enhanced room-temperature ferromagnetism in Sr_3SnO/c-YSZ/Si (001) heterostructures

Y.F. Lee, F. Wu, J. Narayan, and J. Schwartz, North Carolina State University

The magnetic properties of Sr_3SnO (SSO) epitaxial thin films prepared under various post-growth annealing treatments are reported. The SSO films are grown on cubic yttria-stabilized zirconia Si (001) platform by pulsed laser deposition. Post-growth vacuum annealing is found to enhance the room temperature ferromagnetism (RTFM), whereas oxygen annealing reduces it. The results are explained through the oxygen vacancy constituted bound magnetic polarons (BMP) model. An empirical relationship between the extracted BMP concentration and the oxygen vacancy concentration is shown using X-ray photoelectron spectroscopy data. The results indicate a promising way to tune RTFM by manipulating oxygen vacancies and related defects. DOI: 10.1557/mrc.2014.4

Study of relaxation dynamics of photogenerated excitons in $CuInS_2$ quantum dots

Inderpreet Singh, University of Delhi; S. Madan, A. Kaur, J. Kumar, P.K. Bhatnagar, and P.C. Mathur, University of Delhi South Campus

$CuInS_2$ (CIS) quantum dots (QDs) with different diameters were prepared and their optical properties were studied. The optical band gap of QDs, as estimated by absorption spectrum, was found to decrease with increase in size. The stokes shift between absorption and photoluminescence peaks was observed to be larger (>100 meV) in all the three samples. This shows that the defect states available in the forbidden gap dominates the recombination mechanism. The variation in the emission peak with QD size, however, indicates that the relaxation dynamics in CIS QDs involves both excitonic level as well as the defect states. DOI: 10.1557/mrc.2014.5

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