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BOOK OF ABSTRACT

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contribution, we would like to investigate such phenomena and built up a dissociation model for CO_2 which takes into account CO_2 vibrational excited states and the strong coupling of the vibrational kinetics with the electron energy distribution function (eedf).

References

1. A.Goede et al., “Chemical energy storage by CO2 Plasmolysis” XARMAE workshop, Barcelona 8-10 December 2014
2. V. A. Legasov, V. K. Givotov, E. G. Krashennikov, V. D. Rusanov, A.Fridman Sov.Phys.Doklady 238, 66(1977)
3. A.Fridman, “Plasma Chemistry”, Cambridge University Press (2008), New York
4. P. Capezzuto, F. Cramarossa, R. D’Agostino and E. Molinari, J. Phys. Chem. 80, 882 (1976)
5. M.Capitelli and E. Molinari, Topics in Current Chemistry 90, 59 (1980)

#P148 - Enhanced Efficiency of Organic Solar Cells by thiol-capped Au-Nanoparticles

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Organic solar cells (OSCs) are attracting significant interest because of their relevant features such as low cost, ease of manufacture, mechanical flexibility and lightness along with portability. Devices based on poly(3-hexylthiophene) (P3HT) as donor and soluble fullerene derivatives (PCBM)as acceptor are among the most studied, providingpromising power conversion efficiency (PCE). However, low carrier mobility in heterojunction networks remain the major obstacle for improving device efficiency. Because of poor charge transport in the active layer there is competition between the separation and recombination of the photogenerated carriers. Thus, there is a need to develop strategies for increasing light harvesting by the same film thickness. Also, metallic nanoparticles (NPs) are very interesting systems due to their optical and electrical properties. In particular, metal NPs such as Au, Ag, Cu and Pt are known to show plasmon-enhanced absorption which could ensure a greater absorption and an enhanced photogeneration of mobile carriers in the heterojunction films. [1]
In this work, we present a study on the effect of thiol-capped AuNPs of various sizesin an organic solar cell.AuNPs have been obtained by laser ablation in liquid solution[2], have been functionalized both with 2-naphthalenethiol and alkanethiol having different length. In addition to bulk heterojunction structures with optimized interpenetrating network of donors and acceptor domains, we have chosen to study planar heterojunctions (PHJs), consisting of three component thin films realized by sequential deposition of P3HT, AuNPs and PCBM from orthogonal solvents.
These structures have been studied by different microscopy and spectroscopy surface tools. Results show that2-naphthalenethiol-capped AuNPs incorporated at the P3HT/PCBM interface in planar heterojunctions ensures a more efficient charge transfer with respect to heterojunction without AuNPs. Additionally, I/V curves showed that the incorporation of AuNPs with an approximate size of 30 nm can significantly enhance the PCE from 0.7 % to 2.7. Results are discussed in terms of the dependence of fill factor, electron transfer and short circuit current on the morphological order, plasmonic and scattering properties of AuNPs in the thin films.

[1] C.E. Cheng, Z. Pei, C.C. Hsu, C.S. Chang and F. Shih-Sen Chien, Sol. Energy Mater. Sol. Cells, 2014, 121, 80-84.
[2] V. Amendola and M. Meneghetti Phys. Chem. Chem. Phys., 2009,11, 3805-3821

#P149 - COMPARISON OF ACTIVITY IN THE 2-PROPANOL DEHYDRATION OF SUPPORTED HETEROPOLY ACID (PHOTO) CATALYSTS AT THE GAS-SOLID INTERFACE

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2-Propanol dehydration at the gas-solid interface over supported Brønsted acid catalysts based on $H_3PW_{12}O_{40}$ (PW_{12}) Keggin-type heteropoly acid was studied. A continuous flow fixed-bed reactor working at atmospheric pressure and 80 °C and isopropanol initial concentration 0.5 mM was used. Preliminary experiments were performed to find out the flow rate of the feeding gas necessary to avoid mass transport limitation phenomena and hence carry out the experiments in kinetic regime; consequently, a flow rate of 100 ml min^{-1} was used in all the experiments. For the photo-assisted runs the reactor was also illuminated from the top with UV LEDs at different irradiances.The (photo)catalysts included bare and supported PW_{12}. Binary materials have been prepared by impregnation and/or solvothermal treatment by using commercial supports: SiO_2 (Mallinckrodt), TiO_2 (Evonik P25) and carbon nanotubes (Sunnano) or solvothermalhome prepared SiO_2, TiO_2 or ZrO_2. All the materials have been characterized by X-ray diffraction (XRD), scanning electron microscopy observations (SEM) with EDX microanalysis, specific surface area measurements and diffuse reflectance spectroscopy (DRS). The retention of Keggin anion structure throughout the synthesis of catalysts was confirmed both by FTIR and Raman spectroscopies. When the materials were also illuminated the conversion of 2-propanol and consequently the propene formation increased. Propene was the main reaction product, but also the formation of small amounts of di-isopropyletherwas observed; however, the various supported materials showed significant differences. The comparison of the

photocatalysts activity was performed by calculating the rate of propene formation normalized for gram of PW_{12} present in the catalyst. Indeed, the Kegginheteropolyacid species played a key role both for the catalytic and the photo-assisted catalytic reactions.

#P150 - Quantification of the volume and total grain size distribution of the 23 February 2013 Etna lava fountain

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The majority of the plumes produced by explosive eruptions from Mt. Etna, in Italy, are affected by winds oriented from West to East that drive the volcanic ash over the sea, allowing erupted tephra to be sampled at relatively proximal area around the volcano only, i.e. within 20-25 km from the crater. This makes the quantification of fine ash content and the Total Grain Size Distribution (TGSD) very difficult and highly uncertain. Five lava fountain episodes occurred on the New South-East Crater of Mt Etna from 17 to 23 February 2013. On the 23 February, there was a paroxysmal phase that lasted less than 1 hour, producing magma jets higher than 500 m and an eruption plume that reached at least 4-5 km above the crater. The plume was mainly advected by winds oriented from South-West to North-East. This plume produced an extended tephra fallout deposit, allowing lapilli and ash to be sampled at several locations between the slope of Etna and the Puglia region, at about 400 km from the volcano. Here we first quantify the TGSD and the fine ash content for this paroxysmal episode. Then, we use meteorological fields, column height estimation, and TGSD to initialize a computational model of tephra dispersion. Finally, the model simulations are compared with ground measurements and airborne observations allowing us to estimate Mass Eruption Rate and Total Mass through a best fit procedure.

#P151 - Amorphous ferromagnetism and re-entrant magnetic glassiness in Sm2Mo2O7

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We report on the investigation of a high-quality single crystal of $Sm_2Mo_2O_7$ by means of dc magnetometry, muon spin spectroscopy (μ^+SR) and high-harmonics magnetic ac susceptibility [1]. The magnetic phase of the Mo^{4+} sublattice develops below T_C = 78 K, in agreement with several previous reports in the literature. The T_C value would be significantly reduced by a substantial amount of O^{2-} vacancies, showing that this critical issue can be safely neglected for the currently investigated sample. Such magnetic phase for Mo^{4+} is typically discussed in the literature as a conventional itinerant ferromagnetic state. However, our results clearly detect a complicated superposition of conventional and highly disordered magnetic behaviors below 78 K sharing several common features with amorphous ferromagnetic alloys (AmFA) and with other insulating spin-glass (SGI) pyrochlore molybdates. This scenario for $Sm_2Mo_2O_7$ is supported by the anomalously high values deduced for the critical exponents of the magnetic transition, approaching values typically reported for AmFA. These were calculated by a scaling analysis of the dc magnetization data and confirmed by μ^+SR and first-harmonic ac susceptibility. At the same time, μ^+SR detects a sizable static magnetic disorder at the microscopic scale resulting in strongly damped coherent oscillations in the time depolarization of the μ^+ spin. Moreover, the critical divergence of the third-harmonic component of the magnetic ac susceptibility around 80 K leads to additional evidence towards the disordered nature of this magnetic phase. Some degree of magnetic glassiness has been reported in the literature also in the metallic ferromagnetic (FMM) phase near to the metal-to-insulator boundary. However, $Sm_2Mo_2O_7$ is located far enough from such boundary and glassy features are typically neglected in this case. Finally, as typical for several amorphous ferromagnets, a re-entrant spin-glass (RSG) phase is evidenced at low temperatures by means of both the longitudinal magnetic relaxation of $\mu^+$and by magnetic ac susceptibility. Accordingly, our results shed new light on the magnetic properties of $Sm_2Mo_2O_7$ and on the overall electronic phase diagram commonly accepted for pyrochlore molybdates.

[1] G. Prando et al., Phys. Rev. B 90 085111 (2014)

#P152 - Equivalence of chemical and external pressures in RCoPnO

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