

**#P004 - Similar structural dynamics for the CH<sub>3</sub>NH<sub>3</sub>PbI<sub>3</sub> degradation in air and vacuum***Alessandra Alberti - CNR-IMM*

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Lead iodide perovskites have been raising a large attention due to their structural peculiarities and the intriguing transport capabilities. The easy preparation procedure and the competitive electrical behaviour have been pushing forward a rapid development of solar cells based on perovskite-like materials towards record efficiency values (above 20%). Nevertheless, structural stability and degradation issues still remain main concerns that are not fully explored. Their deep knowledge is nowadays mandatory to define proper strategies for a large durability of the photo-active material.

Lead iodide perovskites are unstable especially under air/moisture exposure, which causes degradation towards lead iodide. PbI<sub>2</sub> inclusions in the cell architecture are indeed detrimental for the cell parameters and performances, and therefore some strategies to protect the perovskite layers against ambient exposure have been proposed, (e.g. by Al<sub>2</sub>O<sub>3</sub> or polymeric coatings).

We thus investigate the degradation path of methylammonium lead iodide (MAPbI<sub>3</sub>) films over flat TiO<sub>2</sub> substrates at room temperature by means of X-Ray Diffraction, Spectroscopic Ellipsometry, X-ray Photoelectron Spectroscopy and High Resolution Transmission Electron Microscopy.

We find out that the degradation dynamics is similar in air and vacuum conditions; thereby the water molecules action is not the unique source of instability. We argue that the degradation process has, in both cases, an early stage, which drives the starting tetragonal lattice in the direction of a cubic atomic arrangement, at fixed MAPbI<sub>3</sub> stoichiometry. Such early stage is followed by a phase change with the PbI<sub>2</sub> as the main solid product. This degradation product is structurally coupled with the original MAPbI<sub>3</sub> lattice through the orientation of its constituent PbI<sub>6</sub> octahedra and progressively erodes the starting MAPbI<sub>3</sub> film.

The similarity of the degradation dynamics in air and vacuum highlights the occurrence of intrinsic thermodynamic mechanisms not necessarily linked to humidity.

**#P005 - Modeling and Development of a Double-Tuned (23Na/1H) Birdcage RF Coil for 2.35T Magnetic Resonance Imaging Biomedical Applications***Marcello Alecci - (1) University of L'Aquila, Italy and (2) INFN- LNGS, L'Aquila, Italy*

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Magnetic Resonance Imaging (MRI) is proving to be a very useful tool for proton and sodium quantification in animal models of stroke, ischemia, and cancer. For example, sodium MRI was able to monitor chemotherapeutic response in rat glioma models [1]. To this purpose, specially designed double-tuned RF coils are required and many design configurations have been described in the literature [2-3].

In this work, we present the modeling and development of a dual-frequency RF volume coil suitable for <sup>1</sup>H and <sup>23</sup>Na images of small/medium size samples at 2.35T, made by two coaxial birdcage coils.

A numerical FEM method (HFSS 15.2; eigenmode model; double 6128AMD Operon at 2GHz, 16 cores, 28GB of RAM to run the simulation) was used to model and optimize the RF coil, taking into account the ratio between the coils diameter and length. We also considered the effect of the RF shield on B<sub>1</sub> field intensity and homogeneity. Linear driving of the two channels and a careful angular orientation between the coils minimized the mutual coupling between the <sup>1</sup>H and <sup>23</sup>Na coils.

The current configuration of the dual-frequency RF coil is made of two coaxial birdcage coils: i) a larger (diameter 105 mm, length 160 mm) high-pass birdcage coil comprising 8 copper legs (5 mm width; 35 μm thickness) tuned to the <sup>1</sup>H frequency (100.3 MHz); and ii) a smaller (diameter 90 mm, length 130) low-pass birdcage coil comprising 8 copper legs (5 mm width; 35 μm thickness) tuned to the <sup>23</sup>Na frequency (26.6 MHz). The RF shield is selected with diameter 151 mm and length 210 mm. Without RF shield the coil set was tuned at 2.35T by using <sup>23</sup>Na and <sup>1</sup>H capacitances, respectively, of 385pF and 49pF. In the presence of the RF shield the resonant frequencies of the <sup>23</sup>Na and <sup>1</sup>H coils increase, respectively, of about 10% and 7%. In this condition, the coil was retuned by increasing the <sup>23</sup>Na and <sup>1</sup>H capacitances, respectively, to 480pF and 52pF. Work is in progress to build a prototype suitable for workbench and MRI testing with phantoms and small laboratory animals (mice/rats).

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**#P006 - Point-Of-Care Plastic Biosensor Devices using a PEDOT-modified Electrochemical Glucose Sensing Platform***Yana Aleeva - Università degli studi di Palermo*

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There is an emerging global epidemic of diabetes that can be related to rapid increases in overweight, including obesity and physical inactivity. According to World Healthcare Organization, diabetes is a leading cause of blindness, amputation and kidney failure, while total deaths from diabetes are projected to rise by more than 50% in the next 10 years. To prevent life threatening and debilitating complications associated with diabetes, researchers are continuously involved in developing glucose biosensors. Hence, it is essential to develop a biosensor that can determine glucose levels having fast-response, high sensitivity and selectivity. Depending upon the transduction technique, a number of glucose biosensors have been reported, including electrochemical, optical, and electromagnetic spectroscopy biosensors. Among these types, electrochemical biosensors have been most widely accepted for the sensitive detection of glucose.

Electrochemical biosensors offer an attractive opportunity for quick and sensitive detection of analytes in blood. In the present work, polymer, namely poly(3,4-ethylenedioxythiophene) (PEDOT), films have been electropolymerized on Au electrodes on polyethylene terephthalate (PET) substrates. Glucose oxidase (GOx) enzyme was immobilized on the PEDOT films via glutaraldehyde chemistry. These fabricated plastic biosensors exhibited a high sensitivity of  $7,4 \text{ mA}/(\text{mM}\cdot\text{cm}^2)$  over the clinic range (2-10 mM) of glucose by employing a low cost technology. The biosensors were coupled with an electronic interface just to show the possibility to easily integrate such devices with the emerging technologies including those of smart phones or other wireless based systems able to assist patients in remote. The potential to use our systems for sensing different analytes for a wide range of applications will be discussed. Elettronica su plastica per sistemi "smart disposable" project under PON 2007-2013 program is acknowledged.

### #P007 - Radiative properties of multisubband plasmons in semiconductor quantum wells

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Plasmonic excitations are ordinarily associated to intraband transitions in metal-like electronic systems dressed by the mutual Coulomb interaction [1]. A quasi-two-dimensional electron gas with multiple subbands, such as a highly doped semiconductor quantum well, presents additional plasmonic excitations that originate from intersubband transitions, known as *intersubband plasmons* [2,3], which show several similarities to surface plasmons of metallic nanostructures and have recently become of interest due to strong collective effects in the electromagnetic response [4]. We present a semiclassical theory of intersubband plasmons in quantum wells, based on nonlocal electrodynamics [5]. The theory is formulated in a very general way, and it can be applied to stratified geometries of any degree of complexity, including planar microcavities, where plasmon-polariton effects are predicted. Electrostatic coupling among different intersubband transitions gives rise to strongly radiative modes with subpicosecond radiative lifetimes. These modes are very promising for attaining a significant enhancement of light-matter interaction [6], up to the "ultrastrong coupling regime", where quantum and nonlinear phenomena, such as the dynamical Casimir effect, are expected to play a significant role.

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### #P008 - Polydopamine: beyond its mussel-like features, towards bioelectronic applications.

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Multifunctional melanin-like polymers properties, i.e. broad band absorption in the UV-visible range, the hydration dependent hybrid protonic–electronic conduction and biocompatibility, inspired their implementation as active materials in bioelectronics application. Polydopamine represents an intriguing melanin-like polymer (black melanin-type) mainly known because of its filmability due to the high adhesive (mussel-like) feature. The attention was recently focused also on the polydopamine (pDA) optoelectronic properties, that are showing similarity with the eumelanin ones when embedded in metal–insulator–semiconductor (MIS) devices. pDA n-doping by in-air o-oxidation with aromatic amine resulted in the tuning of the MIS device functioning.

The incorporation within the pDA scaffold of pheomelanin units serving as photosensitizing component is an intriguing bio-inspired strategy for the enhancement of the pDA optical response. This strategy of implementing pheomelanin is based on the synthesis of 5-S-cysteinyl-dopamine product of metabolism, resembling the pheomelanin precursor 5-S-cysteinyl-dopa, and its copolymerization in variable percentage with dopamine p(DA/CDA). When embedded in p(DA/CDA) as the 'insulator' in MIS devices, the copolymer exhibits remarkable impedance properties closer to those of biological materials with a photocapacitive behavior at interesting