

Mestrado Integrado em Engenharia Física

Universidade do Minho

Ciclo de Seminários em Engenharia Física



Metal halide perovskites for photovoltaic devices (recent understanding of their specific electrical properties)

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Abstract

First we remind some data concerning the outlook of world net electricity generation and of world electricity generation from renewable energy, as well the basic steps for conventional photovoltaic (PV) energy conversion based on crystalline silicon (c-Si). In the second part of this talk, metal-halide perovskites are presented as crystalline materials originally developed out of scientific curiosity. In particular, hybrid (organic-inorganic) perovskite solar cells (PSCs) have rapidly emerged as serious contenders to rival the leading photovoltaic technologies. Power conversion efficiencies of PSCs have jumped from 3% over 22% in just six years of academic research. However one of the major obstacles for their commercialization lies in the long term stability of the perovskite films subjected to different environmental conditions such as temperature, moisture and illumination. In the last part of this talk, hybrid perovskite crystals are considered as imperfect ionic crystals, with defects of the Schottky type. A particular attention has been paid on the current density-voltage hysteresis under dark conditions versus initial voltage and temperature for the inverted planar structure. From this experiment we have deduced that electrical conduction is dominated by ions at high temperature, in particular at room temperature. A further spectrochemical technique will be presented, which allows to give direct experimental evidence of halide ionic migration under electrical bias inside the perovskite films. Both experiments prove a link between halide ion migration and current-voltage hysteresis under dark.

Jean-Eric Bouree

Dr Jean-Eric Bouree is officially a retired CNRS researcher, but still active, in the Laboratoire de Physique des Interfaces et des Couches Minces of Ecole Polytechnique, Palaiseau, France. He defended a third cycle thesis on Solid State Physics at the Univ. Orsay in 1970 and a thesis of Doctorat d'Etat in Sciences Physiques at the Univ. Paris in 1975. Dr Bourée initially worked on magnetic insulators with two kinds of magnetic ions, later on the material synthesis for large surface optoelectronics or micro(nanoelectronics) by using different chemical vapour deposition techniques. More recently, he worked on synthesis of aligned carbon nanotubes for field emission flat display technology and for manufacturing nanotransistors (molecular electronics). In each case, Dr Bourée tried to explain the physico-chemical growth processes at the origin of the optical or electronic properties of the various synthesized materials in correlation with the experimental conditions. In the field of photovoltaics, Dr Bouree has been engaged since 1976 in the study and the realization of different solar cells.



O Ciclo de Seminários MIEFis

Este ciclo de seminários, promovido pela Comissão de Curso de MIEFis, visa proporcionar um ponto de encontro entre todos e divulgar a especificidade e o potencial deste curso.

O objetivo de MIEFis é dar uma formação abrangente e sólida em Física, que forneça bases para o desenvolvimento de aplicações em Engenharia. O curso possui dois percursos de formação: *Dispositivos, Microsistemas e Nanotecnologias e Física da Informação*, que resultam da junção de competências existentes nos departamentos de Física, Informática e Eletrónica Industrial da Universidade do Minho. A colaboração com o Laboratório Ibérico de Nanotecnologia (INL) permite o acesso a tecnologias de ponta na área de micro e nanofabricação, com o foco no desenvolvimento de novos produtos na área da nanobiotecnologia e nanoeletrónica, entre outras. A Física da Informação abre uma área de grande impacto tecnológico futuro, que permite compreender e desenvolver novos meios de tratamento da informação e comunicação governados pelas leis da física.

O Ciclo de Seminários proposto conta com a colaboração do QuantaLab, uma plataforma de investigação colaborativa estabelecida entre o INL e a UMinho, na área dos Materiais e Tecnologias quânticas.

