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Charge Transport and Chemical Processes at Interfaces Studied by Advanced Photoelectron Spectroscopy

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Abstract

Processes taking place at interfaces are of general interest and, not surprisingly, drive researchers in a variety of scientific and applicative fields to use surface sensitive techniques, following a key requirement as of the depth sensitivity of the technique. Naturally, depending on the interface(s) of interest, the technique's depth sensitivity dictates its applicability. In this respect, X-ray photoelectron spectroscopy (XPS) is a popular example, proposing considerable reliability in the quantitative analysis of chemical compositions, with exclusive restriction to the top few nanometers, 0.1-15 nm, of a solid surface.

Remarkably, subject to slight modifications only, the XPS instrumentation can be upgraded to also provide unique electrical information, together with the chemical data. This combination opens a whole new dimension in the sensing capabilities of processes occurring at solid surfaces and interfaces. A technique named chemically resolved electrical measurements (CREM) focuses on the development of these capabilities.[1-4] Already demonstrated on a variety of systems, CREM proposes unique sensitivities by a top-contact-free sensor and, combined with real-time chemical information, it offers an important advantages over standard electrical tools.

In this talk I will focus on the study of electric and optoelectronic processes in heterostructures and self-assembled-monolayers (SAMs) in particular. Charge transport processes across heterojunctions consisting of organic spacers between inorganic particles will be described, emphasizing the inseparable role of chemical and electrical characteristics at the active domain.

Biography

Hagai Cohen completed his D. Sc. studies at the Technion—Israel Institute of Technology, Haifa, Israel, in the field of the Physics of solid surfaces. He joined the Weizmann Institute in 1994, where he heads the facility for electron spectroscopy, focusing his research activity on chemical and electrical phenomena at solid surfaces and interfaces. Part of this research includes the development of advanced electron spectroscopy techniques and the CREM technique in particular.

Hagai received a number of research awards including: the Israel Vacuum Society Excellency Award for Surface Science Expertise (2014), the Ofer Lider prize for creativity among scientists (2006), the Maxine Singer Prize for Outstanding Staff Scientist (2003), and the Miriam and Aaron Gutwirth Excellence Prize (1984).

Publications

1. Guest Transition Metals in Host Inorganic Nanocapsules: Single Sites, Discrete Electron Transfer and Atomic Scale Structure
2. Light and complex 3D MoS2/graphene heterostructures as efficient catalysts for the hydrogen evolution reaction
3. Surface Pyroelectricity in Cubic SrTiO3
4. Band alignment and charge transfer in CsPbBr3-CdSe nanoplatelet hybrids coupled by molecular linkers
5. Magnetic-related States and Order Parameter Induced in a Conventional Superconductor by Nonmagnetic Chiral Molecules
6. Vapour transport deposition of fluorographene oxide films and electro-optical device applications
7. Doubly triggered conductance across thin zinc oxysulfide films
8. Dark and photo-induced charge transport across molecular spacers
9. The Contribution of Pyroelectricity of AgI Crystals to Ice Nucleation

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