**X-RAY PHOTOELELCTRON SPECTROSCOPY, A CHEMICAL TOOL FOR ELECTROCHEMİCAL ANALYSES OF POENTIAL DEVELOPMENTS AT LIQUID/SOLID INTERFACES:**

**PAST, PRESENT AND FUTURE**

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Charge distribution, storage and movement in solutions and soft-matter are of paramount importance for understanding and intelligent use of various electrochemical concepts towards advanced applications in energy, chemical, biochemical, microfluidics and sensing. Over the last three decades the vast research efforts using advanced measurement, computational and simulation techniques have changed the old concept of electroneutrality assumed, and most of the time enforced, to be obeyed in many physicochemical processes taking place in solution surfaces or in pores of solid materials. Being a chemically sensitive and quantitative surface analysis technique, x-ray photoelectron spectroscopy (XPS) has been the pivotal method to extract information about distribution of cations and anions on various surface structures, once difficulties in handling liquids had been overcome through multiple advancements in experi­mental techniques. The pioneering XPS investigation of ion enrichment on surfaces of viscous liquids by H. Siegbahn,1 was later successfully extended to aqueous solutions in the form of micro-droplets, using synchrotron based photoemission spectroscopy by Faubel and coworkers.2 In parallel, developments in ambient pressure XPS have enabled investigation of a large variety of critical materials and chemical processes.3 All of these giant leaps and deve­lopments have also been successfully supported and guided by extensive molecular dynamics simulations.Nonvolatile room temperature ionic liquid (RTIL) electrolytes have allowed us and others to utilize lab-based XPS instruments for investigating various electro­chemical processes under ultrahigh vacuum conditions, without the need for extensive pumping techniques nor syn­chrotron facilities. In this contribution, we report on using a similar multi-layered graphene as the top electrode and utilize XPS to monitor in-situ; (i) the changes in the anion/cation inten­sity ratio under applied electric fields, and (ii) the electrical potential developments on different surface structures, which are derived from the shifts in the binding energies of the corres­pon­ding atomic core levels in a chemically resolved fashion.4-10

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