**Your Abstract Title**

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A number of practically important electrochemical processes involve reactions with gases. Some of them, such as oxygen reduction reaction (ORR), oxygen evolution reaction (OER) and hydrogen evolution reaction (HER) are essential for the operation of metal-air batteries, fuel cells and water splitting.  These complex reactions comprise several electrochemical and chemical steps, and generally proceed on the catalytic surface. Although many relevant catalysts (noble metals, transition metal oxides etc.) have been studied for decades, there are still a lot of disagreements regarding the true reaction mechanism on particular catalytic surface.

Electrochemical methods can generally provide only indirect evidence of underlying mechanisms. To draw comprehensive picture, one needs to combine them with the techniques that are sensitive to composition and chemical environment of the atoms participating in electrochemical reaction. A few works demonstrated near-ambient pressure (NAP) XPS studies of electrochemical systems involving OER [1,2] and ORR [3], where catalytic powders deposited onto solid or polymer electrolyte were used as a positive electrode. We suggest to utilize graphene layer as either substrate for the catalytic particles or model carbon electrode, that is transparent for photoelectrons, provides sufficient electrical conductivity throughout the electrode surface, and does not block ionic transport from solid electrolyte to the electrode surface.

We showed that graphene electrode can be used to study ORR mechanism during the discharge of Li-O2 electrochemical cell. Graphene was synthesized by CVD method on Cu foil and transferred onto glass-ceramic Li+-conductive solid electrolyte. Li-O2 cell with Li counter electrode was assembled as reported previously [3]. Gold spot sputtered onto solid electrolyte was used as a quasi-reference electrode.

References:

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