

***In situ* infrared spectroscopy on gold substrates to track film formation and intermediates in Li-ion and Li-air electrolytes**

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The main challenge for *in situ* infrared spectroscopy is to isolate the bands you wish to observe from the background bands arising from, for example the electrolyte. *In situ* attenuated total reflection surface-enhanced infrared absorption spectroscopy (ATR-SEIRAS) is particularly attractive for such spectroelectrochemical experiments [1]. ATR-SEIRAS uses a property of total internal reflection resulting in an evanescent wave. A beam of infrared light is passed through the ATR crystal for example, a ZnSe prism, in such a way that it reflects off the internal surface in contact with the sample (Figure 1). This reflection forms the evanescent wave which extends into the sample. Therefore, this allows one to investigate the surface region of the electrode and discriminate against the bulk electrolyte signal. In the ATR-SEIRAS set-up, part of the evanescent wave passes through a ca. 15 nm thin polycrystalline Au metallic film working electrode. The penetration depth through the Au film and into the electrolyte is typically between 0.5 and 2 μm , with the exact value being determined by the wavelength of light, the angle of incidence and the indices of refraction of the relevant media. We have been developing and optimising this technique, particularly with relation to the Au film deposition, and will report on the study of electrochemical processes in non-aqueous electrolytes in systems that are of interest to understanding film formation and intermediates relevant to both Li-ion and Li-air batteries.

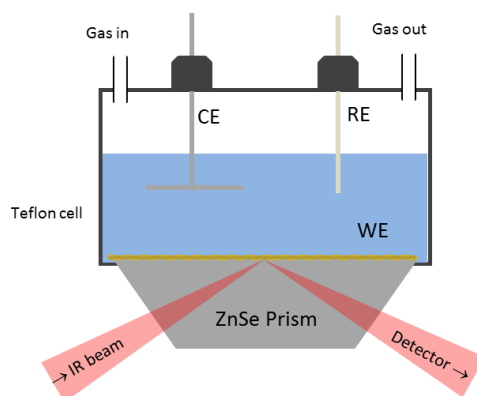


Figure 1. ATR- SEIRAS Cell

[1] M. Osawa, *Topics in Applied Physics*, **2001**, 81, 163-187