**Characterising interfaces with synchrotron-based soft x-ray spectroscopy**

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Often, it may be said that the interface is the device. This quote from Nobel Laureate Herbert Kroemer gets to the heart of modern electronic devices. Indeed, interfacial phenomena are key to the functioning of most semiconductor-based electronic devices and reveal a multitude of fascinating discoveries. Quantitatively characterising interfacial phenomena is one of the greatest challenges of surface and materials science, since buried interfaces can be hardly accessible by many conventional experimental techniques. In this talk, I will discuss a few recent developments in synchrotron-based soft X-ray spectroscopy that have proven capable of providing unique types of information on the electronic/magnetic structures, chemical states, energy level alignments, molecular orientations, sub-fs ultrafast charge transfer dynamics at various kinds of interfaces involving both organic and inorganic materials. In the first part of the talk, I will discuss our recent advances of surface transfer doping of semiconductors, using diamond as an example, to introduce this non-destructive and versatile doping technique applicable to various kinds of emerging electronic materials (Chen *et al.* 2009; Crawford *et al.* 2016; Crawford *et al.* 2018). In the second part of the talk, I will discuss the application of angular-dependent near-edge X-ray absorption fine structure (NEXAFS) spectroscopy to investigate the molecular orientation and its implications to device performances at organic-inorganic and organic-organic heterojunction interfaces (Chen *et al.* 2011; Nerngchamnong *et al.* 2013). Lastly, I will describe how we can quantify the ultrafast charge transfer dynamics across interfaces using core-hole clock (CHC) spectroscopy with unprecedented temporal resolution of sub-fs (Cao *et al.* 2014; Cao *et al.* 2016). The CHC technique allows us to quantify the interfacial charge transfer times with element and site/orbital specificity.

**References**

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