Nanoscale Mapping of Chemistry

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Scanning transmission X-ray microscopy (STXM) is a technique that combines high spatial resolution imaging (up to 7 nm [1]) with X-ray spectroscopy in order to quantify and map the elemental and chemical (i.e. oxidation states and molecular structure) composition of a material. This combination makes STXM a powerful tool for the investigation of chemistry at the nanoscale, such as the distribution of iron oxidation states in Chondrites [2], altered glass [3], particles sampled from a lake [4] and at mineral/biological interfaces [5].

Rich structure in the C K-edge of organic materials corresponding to the anti-bonding states present provides strong differentiation of natural and synthetic organic materials without labelling. Recent STXM investigations have identified and examined micro- and nano-scale polymer particles found in the environment [6].

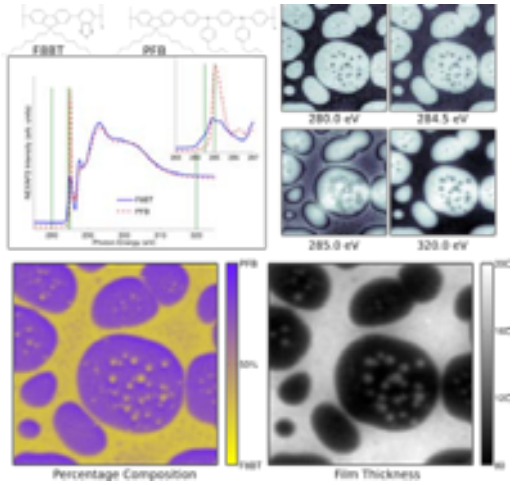

Figure 1: Differences in molecular structure affect the C K-edge X-ray spectra of 2 polymers and thus alter the contrast observed in a blend film measured at corresponding photon energies. Images measured at different points of the spectrum can then be decomposed into quantitative composition maps.

[1] Rösner *et al.* (2018) *Microsc. Microanal.* **24**, 272. [2] Pignatelli *et al.* (2017) *Geochim. Cosmochim. Acta* **209**, 106. [3] Dillmann *et al.* (2016) *Geochim. Cosmochim. Acta* **172**, 287. [4] Miot *et al.* (2016) *Chem. Geol.* **434**, 28-42. [5] Bonneville *et al.* (2016) *Environ. Sci. Technol. Lett.* **50**, 5589. [6] Bigalke *et al.* (2018) *Chimia* **72**, 901.