Ion Beam Analysis of Materials for Energy: Insight on the Outside

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Reactions occurring at interfaces, and particularly surfaces, are key to many carbon neutral technologies, from electrochemical energy conversion in SOFCs to catalysis to the incorporation of hydrogen into alloys. Ion beam analysis techniques are well suited to the analysis of the surfaces of interest, as they probe only the outer few surface layers, and can provide sensitive semi-quantitative analysis. In this talk, I will introduce two of the surface analytical ion beam techniques available within I^{2}CNER / NEXT-FC; namely Low Energy Ion Scattering (LEIS) and Time of Flight Secondary Ion Mass Spectrometry (ToF-SIMS). The former, LEIS, is uniquely sensitive to the elemental composition of the very outer atomic layer of a sample, which controls any interaction with a gas ambient. The second technique, ToF-SIMS, offers sub-100 nm lateral resolution and detection limits in the ppb range. The talk will then explore the powerful synergy between these two complementary techniques, illustrated with examples drawn from my own work and collaborations with I^{2}CNER researchers on solid oxide electrodes, photovoltaics and Li battery electrode materials.