Functional interlayers in organic solar cells: Surface studies and device performance

Organic solar cells (OSC) have been receiving a lot of attention over the last two decades thanks to their mechanical flexibility, light-weight, non-toxic materials, low energy payback times and compatibility with large-scale printing techniques making them a cheaper and more sustainable alternative to the commercially available silicon based solar cells. . The first OSCs faced major challenges achieving high power conversion efficiencies (PCEs) which made them less desirable than their inorganic counterparts, however, the latest OSCs have reached PCE values above 18%, cutting it close to the conventional Si solar cells. Even though the current OSCs have high PCEs, they are still facing challenges in terms of long-term stability, which must be overcome to make OSC mass production a reality.

Functional interlayers used in OSCs play a major role when it comes to the PCE, stability and overall performance of the devices. It is therefore important to use interlayers that possess suitable properties that can enhance the device performance. The electronic structure of the different interlayers and the energy level alignment at their interfaces is a major driving force behind the device performance in OSCs. These properties can be studied using surface sensitive techniques such as X-ray photoelectron spectroscopy (XPS) and X-ray absorption spectroscopy (XAS). This talk focuses on metal oxide interlayers and exciton blocking layers in OSCs. Surface studies of these materials will be presented and their impact on device performance will be discussed.