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Publication date:
2007

Document Version
Publisher's PDF, also known as Version of record

ECASIA '07
12th European Conference on Applications of Surface and Interface Analysis.
Brussels - Flagey - September 9-14, 2007

Tuesday, September 11, 2007 – 09:00 – Room 3

TEC-1295

Characterisation of conductive polymer devices using XPS

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Conductive polymers may form the basis of new generations of active devices. The main advantages include low cost, ease of processing, and direct integration with many other polymer based functional materials. We have demonstrated a simple and versatile new method for fast micropatterning of conductive polymers. Features sizes down to 2 µm have been realised in a conductive polymer film (PEDOT) using a stamp impregnated with an aqueous chemical deactivation agent. The stamp is moulded in bas-relief which enables spatially selective transfer of the deactivation agent from the stamp to the conductive polymer in areas of contact. Conductive polymer films of thicknesses 250-750 nm were micropatterned with some variation in the resulting edge resolution. Identification and spatial mapping of the chemical products resulting from the deactivation procedure are crucial for further optimisation of the patterning process for applications in low-cost polymer electronic devices.

Surface analysis by XPS allows for imaging of surface features by chemical state, allowing the distribution of such chemical products to be mapped across the surface of the device. We present the results of new data processing algorithms which allow high spatial resolution data to be acquired whilst using a probe size much larger than the feature under investigation. Data can also be collected by operating at high pass energy to maximise the signal-to-noise ratio and using further algorithms to decouple the analyser contribution, resulting in spectra with high energy resolution. These advances allow for complex structures with features of a few microns in size to be imaged with significantly reduced acquisition times and much improved chemical state separation.