The evolution of OSC’s performance parameters under mechanical bending

Huda Ahli¹, Peter Bateson¹, Han Zhang², Martyn McLachlan¹

¹ Imperial College White City Incubator, Wood Ln, Shepherd’s Bush, London W12 0BZ, UK
² Queen Mary University of London, Mile End Rd, Bethnal Green, London E1 4NS, UK

Flexible organic solar cells (OSCs) have been gaining a lot of focus lately as they possess the advantages of low cost and light weight [1]. Which make them the most promising photovoltaic devices for wearable electronics and to be used in drones and buildings. However, there is so little known about the evolution of the performance of these cells when they bent or undergo any mechanical testing [2].

In this study we chose to investigate the effect of 3 point flexural bending test on an inverted structure of PBDB-T:ITIC based Organic solar cell fabricated on Polyethylene terephthalate (PET) substrate. to understand the relationship between degree of bending and device performance, 4 different bending radiiuses were studied. The optical, electrical and morphological properties of Indium tin oxide (ITO) coated PET were obtained and compared to the conventional glass ITO substrate to insure its candidacy as an excellent base for cell’s fabrication.

We then investigated the effects of mechanical bending on device performance. Using Finite Element Analysis (FEA) we simulated the stress distribution on the cell during bending (see Figure 1). With the use of Scanning electron microscope (SEM) and Atomic Force Microscopy (AFM) we were able to study the microstructural changes in the device structure and possible interfacial roughening after mechanical bending. We reported the evolution of the electrical property’s changes following the bending test via 4-point probe. To further understand the effects of possible degradation roots, the results were compared to those of incapsulated devices, as flexibility is key, low temperature flexible encapsulating process was used.

![Figure 1. Stress distribution during bending (r= 2.5 cm) on organic solar cell fabricated at the centre of 8 cm long PET substrate.](image)

References: