ELECTRONIC SUPPORTING INFORMATION

From Lab to Fab: how must the polymer solar cells materials design change ? – An industrial perspective

Riccardo Po,* Andrea Bernardi, Anna Calabrese,
Chiara Carbonera, Gianni Corso and Andrea Pellegrino

Research Center for non-Conventional Energies – Istituto eni Donegani,
eni S.p.A., Via Fauser 4, 28100 Novara, Italy

1. Active layer drying tests

The ITO-coated glass substrates were first cleaned with detergent, ultrasonicated in water, acetone and isopropyl alcohol, and dried in nitrogen flux. Four solutions containing a mixture of P3HT:PC60BM with a weight ratio of 1:0.8 in either chloroform, chlorobenzene, 1,2-dichlorobenzene or 1,2,4-trichlorobenzene respectively, with a total concentration of 18 mg/ml, were spin cast (300 rpm, 90 s) on top of ITO obtaining film thickness of approximately 200 nm and left to dry either at room temperature or at 90°C on a hot plate. Images and videos were acquired by an handheld digital microscope (Dino-lite Digital Microscope), with a rotatable polarizer that helps suppressing light reflections improving the visibility of important details.

2. Fabrication and testing of inverted solar cells

Glass/ITO/ZnO/P3HT:PCBM/MoO3/Ag or glass/ITO/ZnO/P3HT:PCBM/PEDOT:PSS/Ag solar cells were fabricated in air by first spin-coating a 0.162 M [Zn^{++}]:2-aminoethanol solution in buthanol on top of cleaned ITO-coated glass substrates (18 Ω/sq, Kintec Co., Hong Kong) at 600 rpm for 150 s. The layer (30 nm) was left to dry in air and then thermally treated for different times at different temperatures. A 18

mg/mL solution of P3HT:PCBM 1:0.8 (wt/wt) in chlorobenzene was then spin coated at 300 rpm for 90 s on top of ZnO. After that, either a layer of MoO_3 (10 nm) was thermally evaporated, or 150 nm of PEDOT:PSS (Clevios CPP 105 D, Heraeus GmbH) was spin coated on top of the active layer (180 nm). In the second case the anode buffer layer was annealed on a hot plate at 120°C for 10 min. The devices were completed by the deposition of silver anode (100 nm) in a thermal evaporator under a vacuum of $2x10^{-6}$ torr. Each substrate contained 3 cells, each one with a nominal active area of 26 mm^2. The effective active area of each cell was measured by using an optical microscope. The film thicknesses were measured on a Veeco Dektat 150 profilometer. Current-voltage characteristics were measured by using a Keithley 2602A sourcemeter. The light intensity of 1.5 AM sunlight from an Abet 2000 solar simulator was calibrated by a KG-5 filtered Si photodiode (Rera Solutions). Solar cells were illuminated trough a 4x4 mm shadow mask.