A simple nanostructured polymer/ZnO hybrid solar cell - preparation and operation in air

A detailed description is given of the preparation of a polymer solar cell and its characterization. The solar cell can be prepared entirely in the ambient atmosphere by solution processing without the use of vacuum coating steps, and it can be operated in the ambient atmosphere with good operational stability under illumination (1000 W m$^{-2}$, AM1.5G, 72 ±/− 2 degrees C, 35 ±/− 5% relative humidity) for 100 h with a 20% loss in efficiency with respect to the initial performance. The dark storability (darkness, 25 degrees C, 35 ±/− 5% relative humidity) has been shown to exceed six months without notable loss in efficiency. The devices do not require any form of encapsulation to gain stability, while a barrier for mechanical protection may be useful. The devices are based on soluble zinc oxide nanoparticles mixed with the thermocleavable conjugated polymer poly-(3-(2-methylhexan-2-yl)-oxy-carbonyldithiophene) (P3MHOCT), which through a thermal treatment is converted to the insoluble form poly(3-carboxydithiophene) (P3CT) that generally gives stable polymer solar cells. The devices employed a solution based silver back electrode. One advantage is that preparation of the devices is very simple and can be carried out by hand under ambient conditions, requiring only a hot plate that can reach a temperature of 210 degrees C, and preferably also a spincoater. This type of device is thus excellently suited for teaching and demonstration purposes provided that the materials are at hand.

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