Student Paper

Surface Plasmon Resonance Effect in Inverted Solar Cells Using Au Nanoparticles

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This work will be presented as oral presentation. Polymer solar cells (PSCs) have attracted lots of research interests in recent years because of their high potential in flexibility, low cost, and the economical roll-in-roll fabrication process [1-3]. To commercialize the PSCs, tremendous efforts have been done to improve their power conversion efficiency. One interesting way to improve the light absorption efficiency is controlling the optical field distribution in devices, such as microcavity effect, photonic crystal, and surface plasmon resonance (SPR) [4-9]. In this work, we investigated SPR effect for efficiency improvement of inverted PSCs using Au nanoparticles (NPs) with varying diameters from 15 to 50 nm. By imbedding a thin layer of Au NPs in the active layer of the PSCs, the power conversion efficiency was improved by a maximum value of 9.2% as compared to the reference device without Au NPs, which is attributed to enhanced local electric field originate from SPR effect. The high resolution TEM (HRTEM) images of the Au NPs are shown in Fig. 1. The schematic illustration and energy band diagram of the devices are shown in Fig. 2 (a) and (b), respectively. In addition to experimental results, theoretical simulation of the local electric field in all devices was performed using finite difference time domain (FDTD) method and will be presented in the meeting.

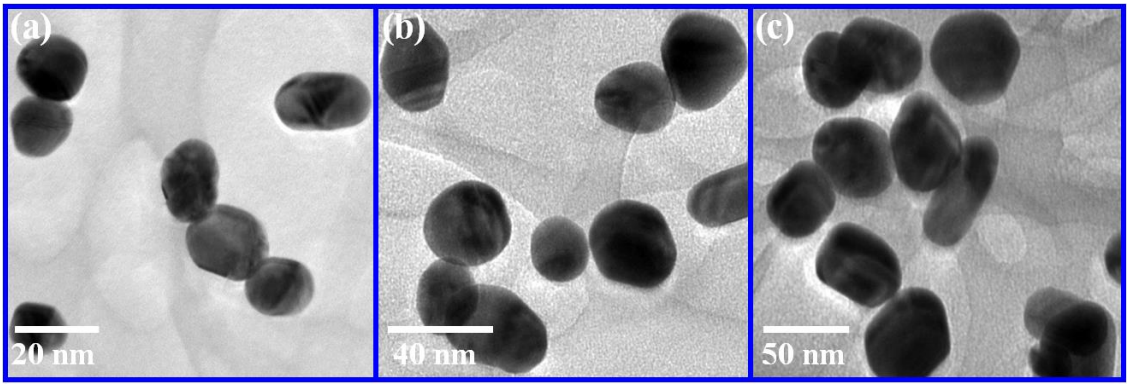

Fig. 1. HRTEM images of Au NPs with varying diameters (a) 15 nm, (b) 30 nm and (c) 50 nm.

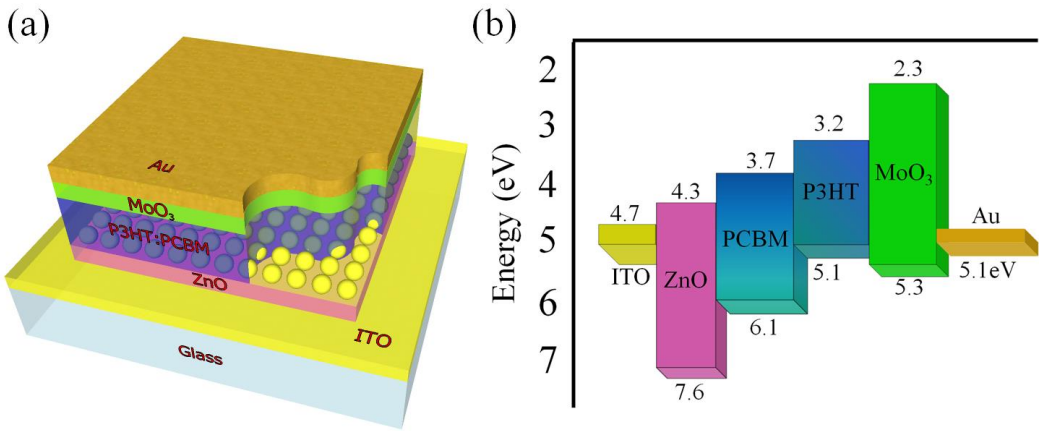

Fig. 2. (a) Schematic illustration and (b) Energy band diagram of the solar cell.

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