E-003

Power Enhance Effect on the Hybrid Cell Based on Direct Current Nanogenerator and an Organic Photovoltaic Device

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Finding renewable and clean energy resources is essential research to solve global warming and depletion of fossil fuels in modern society. Recently, complex harvesting of energy from multiple sources is available in our living environments using a single device has become highly desirable, representing a new trend in energy technologies. We report that when simultaneously driving the fusion and composite cells of two or more types, it is possible to make an affect the other cells to obtain a greater synergistic effect. To understand the coupling effect of photovoltaic and piezoelectric device, we fabricate the serially integrated hybrid cell (s-HC) based on organic solar cell (OSC) and piezoelectric nanogenerator (PNG). The size of increased voltage peaks when OSC and PNG are working on is larger than the case when only PNG is working. This voltage difference is the Voc change of OSC, not the voltage change of PNG and current density difference between these two cases is manifested more clearly. When the OSC and PNG are working in s-HC at the same time, piezoelectric potential (VPNG) is generated in ZnO and theoretical total voltage is sum of voltage of an OSC (VOSC) and VPNG. However, electrons from OSC are influenced by piezoelectric potential in ZnO and current loss of OSC in whole circuit decreases. As a result, VOSC increases temporarily. Current shows the similar behavior. PNG acts a resistance in the whole circuit and current loss occurs when the electrons from OSC pass through the PNG. But piezoelectric potential recover current loss and decrease the resistance of PNG. Our PNG can maintain piezoelectric potential when the strain is held owing to the LDH layer while general PNG cannot maintain piezoelectric potential. During the section that strain is held, voltage enhancement effect is maintained and same effect appeared even turn off the light. Actually at this time, electrons in ZnO nanosheets move to LDH and trapped by the positive charges in this layer. After this strain is held, piezoelectric potential of ZnO nanosheets is disappeared but potential difference which is developed by negative charge dominant LDH layer is remained. This potential acts similar role like piezoelectric potential in ZnO. Electrons from the OSC also are influenced by this potential and the more current flows.

Keywords: piezoelectric, photovoltaic, hybrid, generator, solar cell, energy