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Editorial

Solution Processed Materials for Flash Memory and Organic Photovoltaics

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INTRODUCTION

Flash memory devices have emerged as an attractive research area for both academia and industry to realize light-weight, low-cost, and flexible charge storage media. For advanced flexible electronics, large arrays of printable high performance materials are in a strong demand. The development of solution processable materials for large area device application is still limited. Our research is focused on novel functional materials and materials engineering for the development of printable nonvolatile memory and photovoltaic device applications.

Flash memories based on field-effect transistors with floating gate architecture currently suffer from either high voltage operation or low charge retention. Our aim is to develop memory devices with low power consumption, high program/erase speed and long data retention [1]. The approach is multidisciplinary, which involves materials science, physics, chemistry and electrical engineering. The device fabrication method, nano-material synthesis, fundamental charge transport, device structure design and device performance enhancement in nano-scale electronics, organic-inorganic hybrid devices and especially flexible plastic circuits are investigated [2].

We mainly develop the solution processed two-dimensional materials and nanoparticle arrays as the charge trapping layer [3]. With the optimized parameter of each element, flexible flash memories are realized for practical data storage application.

On the other hand, the development of organic solar cells has got a great deal of attention, leading to a breakthrough of over 10% power conversion efficiency. Further development is still required to ensure future application of organic photovoltaics. One of the major limitations of organic solar cells is the relatively narrow spectral overlap of organic polymer within the solar spectrum.

On this regard, we focus on ternary organic solar cells to extend the absorption spectra of large band-gap polymers to near IR region by the incorporation of self-assembly nanostructures made up of organic small molecules in order to enhance extended light harvesting in bulk-heterojunction solar cells [4]. In addition, we focus on photovoltaic devices with the combination of various shapes of metal nanoparticles to form plasmonic solar cells. When light hits these metal nanoparticles, due to surface plasmon resonance, the light is scattered in various directions [5]. This allows light to travel along the active organic layer and enabling them to absorb more light.

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