display, and touch panels. Indium tin oxide (ITO) is the most widely used material for TE, but, it has some drawbacks: brittleness and scarcity of indium resources. In this regard, various types of research on alternatives, such as carbon nanotube, graphene, and metal nanowires, have been actively carried out. Especially, silver nanowire (AgNW) films have advantages of high optical transmittance and electrical conductivity. However, since AgNW is quite vulnerable to air and moisture, it can be oxidized and corroded easily. To overcome this limitation, we fabricated reduced graphene oxide (rGO)-AgNWs hybrid TEs on poly(ethylene terephthalate) (PET) for improving their electrical conductivities and long-term stability of neat AgNWs. The rGO-AgNWs hybrid TEs can be a promising candidate for ITO and further applied to organic solar cells.

Keywords: Reduced graphene oxide, Silver nanowire, Transparent electrode, Organic solar cell, Flexible device

1P-14

to form a mix of silver and polyethylenimine and poly(acrylic acid) through the repetitive incorporation of Ag nanoparticles within the ionically complexed film. Ag/PEM complexed films have been prepared by concentrated metal/polyelectrolyte multilayer complexation Solution processible and flexible electrical conductor using 1P-16

Solution processible and flexible electrical conductor using metal/polyelectrolyte multilayer complexation

We demonstrate a novel method of creating highly electrical conducting films comprising silver/polyelectrolyte multilayer (PEM) composites. Ag/PEM complexed films have been prepared by concentrated incorporation of Ag nanoparticles within the ionically complexed films of linear polyethylenimine and poly(acrylic acid) through the repetitive protocols of cationic exchange and reduction reaction. The resulting Ag/PEM films are observed fairly good electrical conductivity that is slightly lower than that of bulk Ag by a factor of one order. In addition, the hybridized films can be micro-patterned with photolithographic process. Notably, loading and unloading of Ag nanoparticles from the complexed films is systematically controlled by varying the concentration and time of etching process.

Keywords: layer-by-layer, polyelectrolyte, nanoparticle, percolation, flexible electrode

1P-17

Recombinant protein-immobilized graphene sensor for detection of bisphenol a with high sensitivity and selectivity

Bisphenol A (BPA) is a highly hazardous and carcinogenic compound, especially to infants. For efficient prevention of exposure to BPA, therefore, there is an urgent technological need to develop a novel detection means with high sensitivity and selectivity. To meet this goal, in the present work, we propose an electrochemical detection system based on a sensing platform comprising layer-by-layer assembled reduced graphene oxide (rGO) electrode and surface-immobilized probes of recombinant protein of Lac repressor (LacI). Electrochemical impedance spectroscopy (EIS) was conducted to confirm the feasibility of the present system as an impedimetric sensor. It showed a minimum detection limit down to 5.0 DM. To confirm the selectivity of the screened peptide sequence, BPA analogues such as Bisphenol S (BPS) and Bisphenol F (BPF) were also assessed.

Keywords: Electrochemical impedance spectroscopy, Bisphenol A, Reduced graphene oxide, Recombinant Lac repressor, Biosensor

1P-18

Si/Ti2O3/reduced graphene oxide nanocomposite anodes for lithium-ion batteries with highly enhanced cyclic stability

Silicon (Si) has attracted tremendous attention as a high-capacity anode material for Li-ion batteries (LIB), unfortunately, it suffers from poor cyclic stability due to excessive volume expansion and reduced electrical conductivity after repeated cycles. To circumvent these issues, we propose a ternary nanocomposite of Si/Ti2O3/reduced graphene oxide (rGO) using mechanical blending and subsequent thermal reduction process. As a result, the obtained ternary nanocomposite exhibited a specific capacity of 985 mAh/g and a Coulombic efficiency of 96.4% after 100 cycles at a current density of 100 mA/g. This excellent electrochemical performance can be ascribed to the improved electron and ion transport provided by the Ti2O3 phase within the Si domains and the structurally reinforced conductive framework comprised of the rGO nanosheets. Therefore, it is expected that our approach can also be applied to other anode materials for high-performance LIBs.

Keywords: silicon, lithium-ion batteries, anode

1P-19

Composite of using Polycarbonate and Multi wall carbon nanotubes grafted by poly methyl methacrylate

Since the discovery of carbon nanotubes (CNT) considerable attention has also been focused on CNT containing polymeric composites, due to the inherent unique mechanical and electrical properties of CNT. In this work, We aim to develop mechanical properties of Polycarbonate(PC) that used in a wide variety of common products including electronic equipment, automobiles, sports safety equipment and medical devices. We compose PC and multi wall CNT(MWNT) for improving mecha-