ABSTRACT

At the present time, the rapidly mounting global economy has caused serious environmental problems and extreme consumption of fossil fuels, resulting in significant threats to the survival and progress of humankind. Thus, utilizing sustainable and clean energy in addition to efficient energy storage and conversion technologies is urgently required. It was predictable that the world will require doubling its energy supply by 2050. For this purpose, advanced technologies for both energy conversion (solar cells and fuel cell) and storage (supercapacitors and batteries) are being widely studied around the world. Recent years have accrued major progress in the theoretical and practical research and development of electrochemical supercapacitors. Simultaneously, the drawbacks of electrochemical supercapacitors including low energy density and high production cost have been recognized as major challenge for the advancement of electrochemical supercapacitors technologies. To overcome the barrier of low energy density, one of the most extensive approaches is the improvement of new materials for electrochemical supercapacitors electrodes.

In this present study, we have develop hybrid materials for electrochemical supercapacitor electrodes based on conducting polymer, acid modified multi-walled carbon nanotubes, single-walled carbon nanotubes and graphene. Transition metals doping on the conducting polymers in presence of both multi-walled carbon nanotubes and single-walled carbon nanotubes enhances the electrochemical properties. Incorporation of silver nanoparticles on the conducting polymers in presence of multi-walled carbon nanotubes and graphene also enhances the electrochemical characteristics. Depending on the outstanding electrochemical performances, these nanocomposites can be used as the superior electrode materials for electrochemical supercapacitors.

Keywords: *Supercapacitor; multi-walled carbon nanotubes; single-walled carbon nanotubes; graphene; conducting polymers; silver nanoparticles.*