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## How to enhance the electrochemical performance of supercapacitors and photocatalysts?

Electrical Double Layer Capacitors (EDLC) such as activated carbon has high power densities but do not have high energy densities, which hurdles the use of supercapacitors in many commercial sectors. To overcome this problem, many researchers have been working to improve the energy density of supercapacitors. Metal oxides or sulfides have been employed to exploit their pseudocapacitive natures in energy storage (supercapacitor) and photo catalyst applications. They have shown good electrochemical performances but have not been satisfactory. Various materials such as graphene and carbon nanotubes have studied to enhance the electrochemical properties owing to their large surface area and high electrical conductivity. Synergistic effects of excellent conductivities of graphene and high electrical properties of metal oxides or polymers have improved the overall electrochemical performances tremendously. In this study, graphene, graphene oxide and reduced graphene oxide have been tested for improving performances as supercapacitors and photocatalysts. Other methods have also been used such as doping of graphene with nitrogen or sulfur using metal sulfides instead of metal oxides and using highly porous materials as substrates. In the synthesis of these materials, a cleaner technology has been employed.

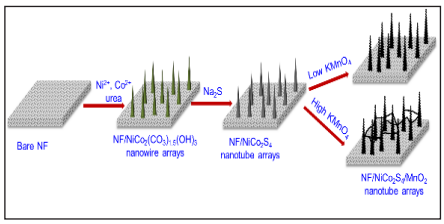


Figure-1: Illustrative fabrication process toward the $NF/NiCo_2S_4@MnO_2$ electrode.

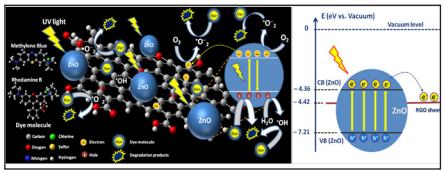


Figure-2: Mechanism of the photo degradation of dyes and illustration of electron transfer between the RGO sheets and ZnO under UV light in the presence of the ZnO/RGO catalyst.

### Recent Publications

1. Mady A H, Baynosa M L, Tuma D, Shim J J (2017) Facile microwave-assisted green synthesis of Ag-ZnFe2O4@rGO nanocomposites for efficient removal of organic dyes under UV- and visible-light irradiation. *Applied Catalysis B: Environmental;* 203: 416-427.
2. Sahoo S, Shim J J (2017) Facile synthesis of three-dimensional ternary ZnCo2O4/reduced graphene oxide/NiO composite film on nickel foam for next generation supercapacitor electrodes. *ACS Sustainable Chemistry and Engineering*; 5(1): 241-251.

### Biography

Jae Jin Shim has completed his BSc degree from Seoul National University in 1980; MS degree from KAIST in 1982 and PhD degree from the University of Texas at Austin. He has been a Professor in Yeungnam University since 1994 and served as School Chairman and Vice-Dean of Engineering. He has served as the President of the Korean Society of Clean Technology and Vice President of the Korean Society of Engineering Education. He is the Director of the Institute of Clean Technology and The Clean Energy Priority Research Center. He has published more than 150 papers in reputed journals and served as the Chief Editor of *Clean Technology*. His current research interests are synthesis and applications of graphene (or carbon nanotube)-based nanomaterials for supercapacitors, catalysts and sensors; syntheses of polymers and organic materials using supercritical fluids and ionic liquids; living polymerization in supercritical fluids and ionic liquids and clean technology.

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