All-in-one Supercapacitors with high performance Asymmetric Configurations of Reduced Graphene-Quinoline Zinc Phthalocyanine Electrodes

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Phthalocyanines (Pcs) are macroheterocyclic compounds consisting of four isoindole units bonded to each other by nitrogen atoms at meso positions and can be obtained by changing the central metal ion and peripheral substituents and are used as pigments and have many applications such as energy conversion, gas sensor and liquid crystal. Quinoline is a heterocyclic aromatic organic compound that has various pharmacologically active synthetic and natural compounds of its derivatives are common [1]. The graphene family includes reduced graphene oxide (rGO), graphene oxide (GO), graphene sheets, and several-layer graphene members. GO has unique physical and chemical properties [2].

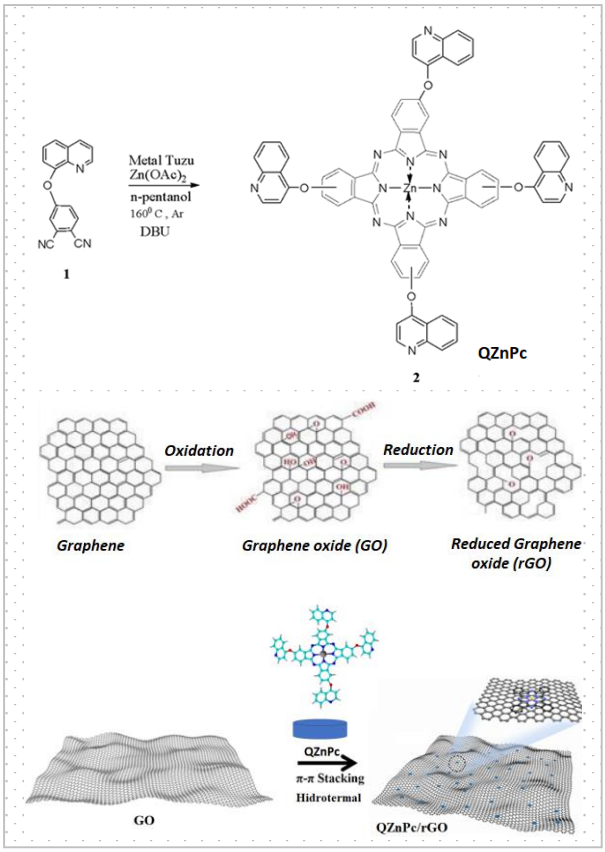

Figure 1. Schematic illustration of preparation for the QZnPc/rGO electrode

In this study, graphene oxide were obtained first, starting from graphite. Then, quinoline substituted phthalonitrile ligand was obtained. Qunoline zinc phthalocyanine (QZnPc), was obtained as a result of the reaction of this compound with metal salts under classical method conditions. The molecular structures of these newly synthesized substances were characterized by several spectroscopic methods. Later, new QZnPc/rGO nanohybrid material has been obtained as a result of the hydrothermal reduction reaction of GO with QZnPc we have also synthesized [3] (Fig. 1). Various methods were tried and their results were compared. Analysis and characterization of these obtained electroactive materials were made by methods such as FT-IR, BET, SEM, Raman, XRD, TGA. The results were successful as expected.

After the necessary characterizations are made, with this method, the electrode materials to be used in energy storage systems; CV, GCD and EIS electrochemical analysis techniques were applied to obtain information about supercapacitor performances and to examine its usability in the field of energy storage. This work provides a pathway to develop multi-functional composite structures with high storage capability to promote new technologies in scalable applications of new energy power generation systems.

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References

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Bahadir Keskin received his M.S. and Ph.D. degrees in inorganic chemistry from Yildiz Technical University in 2010, and now working there as Assos. Prof. Dr. since 2001. He did postdoctoral fellows in Department of Chemistry & Biochemistry at the North Dakota State University and University of Minnesota Duluth. His research interest is focusing on synthesis, modification of 2-D materials, phthalocyanines and their energy applications such as hydrogen energy, sensors, batteries, supercapacitors, and solar cells.

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