Cost-effective, solvothermal synthesis of heteroatom (S or N)-doped graphene developed

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A research team led by group leader Yung-Eun Sung has announced that they have developed cost-effective technology to synthesize sulfur-doped and nitrogen-doped graphenes which can be applied as high performance electrodes for secondary batteries and fuel cells. Yung-Eun Sung is both a group leader at the Center for Nanoparticle Research at Institute for Basic Science* (IBS) and a professor at the Seoul National University.

This achievement has great significance with regards to the development of relative simplicity, scalablity, and cost effectiveness processes that can produce heteroatom (S or N)-doped graphenes. Moreover, these materials enhance the performance of secondary batteries and drive down the cost of producing fuel cells. This process using common laboratory reagent, sodium hydroxide (NaOH) and heteroatom-containing organic solvents as precursors. The research team was able to synthesize sulfur-doped and nitrogen-doped graphenes by using a simple, single-step solvothermal method.

These heteroatom-doped graphene exhibited high surface areas and high contents of heteroatoms.In addition, the lithium-ion batteries that had modified graphenes applied to it, exhibited a higher capacity than the theoretical capacity of graphite which was previously used in lithium-ion batteries. It presented high chemical stability which resulted in no capacity degradation in charge and discharge experiments. The

heteroatom-doped graphenes suggest the potential to be employed as an effective, alternative chemical material by demonstrating performance comparable to that of the expensive platinum catalyst used for the cathode of fuel cell batteries. Platinum has a high profile because of its high chemical reactivity and electrocatalytic activity. However, limited resources and high expense have been stumbling blocks in its effective commercialization.

Group leader Yung-Eun Sung of the Center for Nanoparticle Research at IBS, says, "We expect that our synthetic approach will be developed to produce doped carbon materials based on other elements (e.g., florine, boron, phosphorus) which can then increase the method's potential applications in fuel cells, lithium secondary batteries, sensors, and semi-conductors."

More information: "Single Source Precursor-based Solvothermal Synthesis of Heteroatom-doped Graphene and Its Energy Storage and Conversion Applications", Bo Quan, Seung-Ho Yu, Dong Young Chung, Aihua Jin, Ji Hyun Park, Yung-Eun Sung & Yuanzhe Piao, *Scientific Reports*, Published: 10 July 2014, DOI: 10.1038/srep05639

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