IBS Center for Multidimensional Carbon Materials

Tuesday Colloqium

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Ultrasonic Chemical Reaction for Energy Storage System

Dec 12
Tues 14:00

Bldg. 101
Seminar Room on the 1st floor

Direct bond formation of carbon-hetero atom, like carbon-nitrogen (C-N) and carbon-oxygen (C-O), remains extremely challenging task from inert nitrogen or oxygen gas, although it is very essential chemistry in both chemical/biological processes (e.g plant fertilizer) and energy storage system (e.g nitrogen doped carbon electrode).

Here I will describe a simple and ultrafast method to form C-N or C-O, in various carbon nanomaterials including activated carbon, carbon nanotubes, and graphene, by ultrasonic chemical reaction and then fabricate it binder-free energy storage system in situ without any further thermal or chemical treatment.[1] Ultrasonic chemistry is used for activating carbon nanomaterials by ultrasonic spray, whose collision with the carrier gas molecules (N_2 or O_2) introduced heteroatom doped into carbon nanomaterials. As a result, it simply fabricates nitrogen or oxygen doped carbon electrode (N-RGO or O-RGO) for binder-free energy storage system. Moreover, two-dimensional reduced graphene oxide (rGO) and one-dimensional carbon nanotubes (CNTs) are deposited layer-by-layer (LBL) to form periodic, nanoporous and interdigitated electrodes, which result in excellent special capacitance as well as high cycling stability and structural flexibility.
In addition, using ultrasonic chemistry, hetero and multi atom-doped graphene are easily available instead of harsh conditions. This ultrasonic chemistry can expand into synthesis of covalent organic frameworks and then apply it supercapacitors in-situ. The performance of energy storage and its stability are greatly enhanced by the LBL deposition of CNT.

References:

1. Kim, H. T.; Shin, H.; Jeon, I. Y.; Yousaf, M.; Baik, J.; Cheong, H. W.; Park, N.; Baek, J. B.; Kwon, T. H., Carbon–Heteroatom Bond Formation by an Ultrasonic Chemical Reaction for Energy Storage Systems. *Adv. Mater.* **2017,** *29*, 201702747.

You are cordially invited to attend!