Dieter M Gruen, Res. Rev. J Mat. Sci. 2018, Volume 6
DOI: 10.4172/2321-6212-C3-019

Dieter M Gruen

Dimerond Technologies, USA

Hybrid conversion solar system (HYCSOS)

With increasing energy and environment concerns, how to efficiently convert and store energy has become a critical topic. Electrochemical energy storage devices, such as supercapacitors and batteries, have been proven to be the most effective energy conversion and storage technologies for practical application. Supercapacitors and lithium-based batteries are particularly promising because of their excellent power density and energy density. However, further development of these energy storage devices is hindered by their poor electrode performance. The carbon materials in supercapacitors and batteries, such as graphite, activated carbons and various nanostructured carbon materials (ordered porous carbon, CNT, graphene etc.), are often derived from nonrenewable resources under relatively harsh environments. Naturally abundant biomass with hierarchically porous architecture is a green, alternative carbon source with many desired properties for supercapacitors and lithium-based batteries. Recently, we converted cotton, banana peel, and recycled paper into highly porous, conductive activated carbon scaffolds for advanced energy storage applications via a low-cost and high throughput manufacturing process. The activated carbon scaffolds were further coated with active materials such as $NiCo_2O_4$, NiO, Co-Al layered double hydroxides (Co-Al LDHs), Ni_2S, sulfur nanoparticles, and graphene to enhance their electrochemical properties. The biomass-derived activated carbon materials are effective in improving supercapacitor's energy density and in blocking the dissolution of reaction intermediates in lithium sulfur batteries. Especially, the biomass-derived carbons provide scaffolds for hosting sulfur in lithium sulfur batteries to manipulate the "shuttle effects" of polysulfides and improve the utilization of sulfur. In particular, the activated carbon textiles (derived from cotton textiles) are flexible and conductive, and an ideal substrate for constructing flexible supercapacitors, batteries, and self-powered flexible solar cell/supercapacitor (or battery) systems. Using biomasses is definitely the right track towards making renewable carbon materials for future energy storage devices.

Recent Publications

1. Mareš J J, Hubík P, Krištofik J, Kindl D, Fanta M, Nesládek M, Williams O and Gruen D M (2006) Weak localization in ultra-nano crystalline diamond. Applied Physics Letters. 88: (092107).
2. Auciello O, Krauss A R, Gruen D M, Meyer E M, Busmann H G, Tucek J, Sumant A, Jayatissa A, Moldovan N, Mancini D C and Gardos M N Two- and three-dimensional ultra-nano crystalline diamond (UNCD) structures for a high resolution diamond-based MEMS technology. Materials Research Society Symposium 605:73-78.
3. Dhote A M, Auciello O, Gruen D M and Ramesh R (2001) Studies of thin film growth and oxidation processes for conductive Ti-Al diffusion barrier layers via in situ surface sensitive analytical techniques. Applied Physics Letters 79:800-802.
4. Busmann H G, Pageler A, Brauneck U and Gruen D M (2000) Grain boundaries and mechanical properties of nanocrystalline diamond films. Journal of Metastable and Nanocrystalline Materials 8:255-260.
5. Auciello O, Krauss A R, Jaemo I M, Dhote A, Gruen D M, Aggarwal S, Ramesh R, Irene E A, Gao Y and Mueller A H (1999) Studies of ferroelectric heterostructure thin films, interfaces, and device-related processes via in situ analytical techniques. Integrated Ferroelectrics 27:103-118.

Biograpy

Dieter M Gruen is an Argonne Distinguished Fellow, Emeritus and President of Dimerond Technologies, LLC's. He has completed his BS cum laude and MS degrees at Northwestern University and his PhD in Chemical Physics at University of Chicago. He had a distinguished research career involving several disciplines of material science relevant to fission and fusion energy.

dietergruen@comcast.net