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EDITORIAL

Topical issue on "hybrid materials and design in electrochemistry"

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There has been considerable growth of interest in hybrid concepts in a variety of research fields. In particular, many materials chemists have been attracted in the last 10 years to create new materials with the best of multiple components or with unique multi-functionality. The hybridization of materials can be done on their microstructure (crystalline/amorphous/porous), grain or particle size (nano/micro/macro), and material itself (metals/ceramics/polymers/composites). The individual hybrid components are interactively blended to reveal unique and/or extraordinary materials properties. Concomitantly, the hybridization of multiple processes or devices has also been widely exploited to mutually supplement each others' advantages or performance. Exemplary cases are the hybridization of the preparation techniques (electric field/plasma/laser/ultrasonic wave) and energy sources (battery/capacitor/fuel cell/flywheel).

This topical issue of the *Journal of the Solid State Electrochemistry* focuses particularly on the hybridization of materials and processes in the field of electrochemistry as a newly emerging and highly challenging research field. A variety of composite electrodes such as PtRu/carbon nanotubes (CNT), Pt (Co, Ni), polyaniline/SnO_2, and Pd-zeolite-modified graphite electrode together with inorganic/organic composite membrane are suggested for the promising hybrid components for high-performance fuel cell. The studies on Ru oxide/carbon fabric composites, CNT/diamond hybrid electrodes, barrier/porous TiO_2, and composite polymer electrolyte show the potential applications of hybrid materials to supercapacitors, Lithium-ion batteries, and sensors. As regards the electrochemical preparation, modified and new strategies on Bi_2S_3, CdSe, and Fe_2O_3/SiO_2 coatings and electrochemical synthesis of conducting polymers are quite attractive. And, sophisticated three-dimensional hybrid porous structures of Cu and diamond/Ti give us a new insight to the design of functional electrochemical devices with utmost performance.

Although only a fraction of works on hybrid concepts in electrochemistry are included in the topical issue, the individual articles deserve attention for their pioneering contributions to this challenging field. We hope that the works collected here are informative and beneficial to the readers. Finally, with special thanks to Prof. Fritz Scholz and Dr. Michael Hermes, we would like to express sincere gratitude to all authors and reviewers for their efforts and time to make the special issue possible.

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