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Functional nanostructure arrays realized by templates for energy conversion and storage devices

Prof. Dr. Yong Lei
Technical University of Ilmenau, Germany

Functional nanostructures have drawn intensive attention with the development of miniaturization of modern and future devices. Realization of such nanostructures presents an important task for nanotechnology research and device applications. To address this challenge, template-based method provides a perfect approach owing to the geometrical characteristics of the templates. We have developed template-based nanostructuring techniques using anodic aluminum oxide (AAO) nanopore arrays and polystyrene spheres with scalable, parallel and fast processes.[1] Employing these techniques, three-dimensional and surface nanostructures have been fabricated. The obtained nanostructures possess large-scale arrayed configuration, high structural density, perfect regularity and cost-effectiveness, and are highly desirable for constructing energy conversion and storage devices, including solar water splitting,[2-6] supercapacitors[7-9] and rechargeable sodium-ion batteries.[10-13] The device performances demonstrated that the obtained nanostructures benefit these applications through the precise control over the structural features enabled by the geometrical characteristics of the templates.[14,15] These achievements indicate the high potential and importance of template-based nanostructuring techniques for both basic research and device applications. Especially, we proposed recently a multiple nanostructuring concept using a binary-pore AAO template,[16] indicating a new perspective of template-based nanostructuring for device functionalization.

yong.lei@tu-ilmenau.de