Fabrication of robust superhydrophobic surfaces

Superhydrophobic surfaces of polytetrafluoroethylene by a simple process

We report an efficient, facile and inexpensive process for large area fabrication of robust hydrophobic surfaces with tunable water contact angle up to >150°. The process is essentially a template-based hot-imprinting procedure. We choose wire mesh as the template and polytetrafluoroethylene as a substrate. Compared with other imprinting methods, the advantages in choosing wire mesh as the template are: (1) the shapes and sizes of the features are tunable via changing wire mesh; (2) wire mesh can be fixed on either flat or tubular surfaces, and applicable to various substrate shapes; (3) such templates are easily peeled off from the substrate simply by lifting without any additional step; (4) the templates are robust and can be used repeatedly; (5) wire mesh is commercially available at low cost from industrial batch-processing, and is woven with various weave methods and can cover large areas.

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AIST TODAY Vol.8, No.10 p.22 (2008)

A: Photo of thin polytetrafluoroethylene film placed on the letters "AIST" before thermal transfer and water contact angle(110°)
B: Photo after thermal transfer and water contact angle(154°)

Real-space observation of Li extraction/insertion in positive electrode material for Li-ion batteries

Toward developing the advanced positive electrode materials for Li ion batteries

We achieved real-space direct observation of the extraction and insertion behaviors of Li ions by using a spectrum-imaging method based on scanning transmission electron microscopy (STEM) and electron energy-loss spectroscopy (EELS). It was found that the Li ions were firstly extracted from Fe-rich $LiFeO_2$ nanodomains and subsequently extracted from Mn-rich Li_2MnO_3 nanodomains to extend to the whole region of the particle in a high-capacity positive electrode material, $Li_{1.2}Mn_{0.4}Fe_{0.4}O_2$ (Li_2MnO_3–$LiFeO_2$). After discharge, Li ion insertion was confirmed by the Li mapping images. These results indicate the role of nanodomain structures in activating both $LiFeO_2$ and Li_2MnO_3 domains, which are each inactive in pure bulk form.

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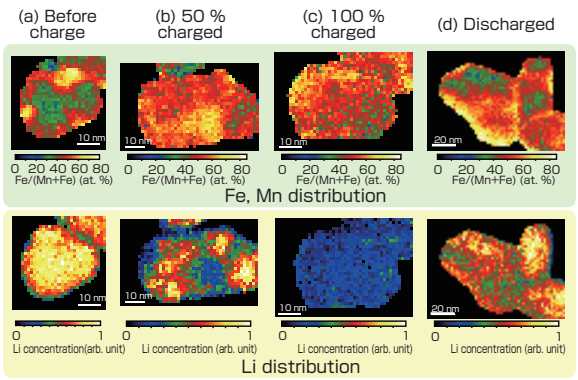
AIST TODAY Vol.8, No.11 p.21 (2008)



Observation of Li extraction and insertion by STEM-EELS spectrum imaging. Fe/(Mn+ Fe) maps (upper column) and corresponding Li concentration maps (lower column)