

Nanobubble-assisted surface nanopatterning

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Ambient gas nanobubbles (NB) of size $\sim 10^1 - 10^2$ nm appearing at hydrophobic solid/hydrophilic liquid interfaces can cause rearrangement and nanopatterning of solid surfaces. Hydrophobic solids - basal plane highly ordered pyrolytic graphite (HOPG), polymeric films of polystyrene and polytetrafluoroethylene (Teflon) respectively, were interfaced with deionized water (DIW) at room temperature and investigated both in situ and ex situ by AFM, Raman spectroscopy, XPS and HRTEM/SAED respectively. Nonoxidative room temperature exfoliation took place on basal plane HOPG surface exposed to DIW, followed by subsequent rolling to graphene-based nanoscrolls, nanohorn-like and onion-like nanoparticles resolved by HRTEM/SAED. Accordingly, nanobubble engagement appears to act in restructuring of polystyrene (PS, $E_{YM} \sim 3-3.5$ GPa) and PTFE (Teflon, $E_{YM} \sim 0.5$ GPa) surfaces respectively, manifested by formation of large area network of nano-protrusions and imprints, which patterns are consistent with nanobubbles appearance. Though the mechanism of presumed nanobubble-assisted nanostructuring of solid surfaces is not fully clarified yet, forces acting at the nanobubble perimeter-ternary interface can be considered. Their magnitude may exceed substantially force values elucidated from so-called NB-assisted surface "cleaning" ($E_{TStress} \sim 20$ MPa) manifested as removal of deposited thin films and adsorbate layers respectively. The influence of experimental conditions, proposed model of nanobubble/solid surface interaction and ternary interfacial forces acting at the surface nanopatterning are discussed.

Biography

Pavel Janda completed his Ph.D. at J. Heyrovsky Institute of Physical Chemistry, Prague, Czech Republic. Since then he was engaged in charge transfer kinetic on electrodes with modified surfaces for electrocatalysis and electrochemical sensors. He is focused on correlation nanomorphology and charge transfer processes of supported nanoparticle assemblies and gas nanocavities on solid liquid interfaces. He has published more than 60 papers in reputed journals. He is the project & group leader of Scanning Probe Microscopy Group, deputy head of Dept. of Electrochemical Materials in JHI, member of executive board of Czechoslovak Microscopic Society and member of European Microscopic Society.

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