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Novel synthetic process of graphene shell for energy materials and devices

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Graphene is one-layer carbon atoms arranged in a hexagonal lattice, which has many superior properties such as mechanical strength, specific surface area, heat and electron conductivity, and high transparency. For the past decades, most researchers have worked for the development of defect free graphene, because graphene often lose its inherent properties even by small defects. However, when graphene is used for catalytic applications such as protective layer of nano metal catalyst, proper amounts of defects can boost the catalytic performance. For the synthesis of porous graphene shell, we have developed single-step chemical vapor deposition (CVD) technique. We have synthesized core-shells type catalysts consisting of Pt or Co nano-core with porous graphene shells. The resultant core-shell catalysts showed high performance with longterm stability in applications for fuel cell catalyst, secondary battery electrode materials, and hydrogen evolution reaction catalyst.

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Introduction of new methods in ultrasound- mediated microbubbles drug delivery in cancer therapy

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Introduction: Despite of various drug delivery systems, microbubbles (MBs) as a contrast agent in ultrasound have a promising future. They include a shell made of materials such as lipid, protein etc. as well as a gas core. In this paper, some new methods for drug delivery in cancer therapy by MBs and monitoring by ultrasound are explained.

Methods: A microbubble containing phospholipid monolayer in shell is connected to either several monolayer nanoliposomes or a multilayer liposome by a powerful ligand like avidin-biotin or digoxigenin-antibody. For increasing blood circulation time, MB and liposome/s are coated by polyethylene glycol. Regarding hydrophilic or hydrophobic, the given drug is attached among phospholipid tails or heads. For targeting MB, an antibody complementary to antigen expressed just by cancerous cells is loaded on its surface. After injecting MB-liposome couple, as the targeted MB has higher degree of echogenicity than other tissues, it can be monitored and located by ultrasound. In other method, MB inserted into a liposome with drug amount incorporated in membrane of MB less than one in liposome membrane. Oscillation of MB under lower acoustic pressure causes shear stress in membrane followed by increasing intracellular permeability and reducing damage to the tissue.

Results: As mentioned above, the payload of drugs is increased through multiplicity of liposomes or layers. Moreover, decreasing side effects and precise monitoring MBs are remarkable outcomes.

Conclusion: Ultrasound-mediated MBs drug delivery is considered as a progressive technique in simultaneously cancer tissue imaging and therapy.

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