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Large-scale high quality monolayer graphene grown directly at 150°C via plasma-assisted thermal CVD without transfer process

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Direct graphene growth on functional substrates via chemical vapor deposition is an attractive approach to manufacturing flexible electronic devices, as it avoids the drawbacks of transferred graphene. To fabricate flexible devices on plastic substrates, the growth temperature must be below ~200 °C to prevent substrate deformation. Here, we report the direct growth of wrinkle and defect-free graphene on flexible substrates at low temperatures and without transfer processes. We show that defect-free graphene can be directly grown on a variety of substrates via the introduction of an ultra-thin titanium buffer layer, due to perfect lattice matching between titanium and carbon atoms. We further show that *ex situ* Ti layers (Ti_xO_y) with a thickness of ~10 nm does not influence the transmittance or electrical conductivity of functional substrates. We report theoretical and experimental evidence for large-scale (4×4 cm^2) high-quality graphene grown on *in situ* deposited titanium-buffered substrates at 150 °C in a CH_4/H_2 atmosphere via plasma-assisted thermal CVD. We applied the proposed methodology to fabricate flexible and transparent thin-film capacitors with direct grown top- and bottom-graphene electrodes. These findings could pave the way to the practical exploitation of flexible electronic devices via large-scale high-quality monolayer graphene grown directly with no transfer processes.

Biography

Soon-Gil Yoon has received his PhD from the Korea Advanced Institute of Science and Technology (KAIST), Korea in 1988. He is a Professor in Department of Materials Science and Engineering, Chungnam National University, Republic of Korea. His current research interests are thin film capacitor, fusion technology of solar cell, etc. He has published 310 SCI papers.

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