

## Properties-controllable Graphene synthesis and applications in electronics and photonics

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Graphene has attracted enormous interest with excellent electronic and photonic properties. Its charge mobility, electrical conductivity and optical transparency in addition to its flexibility, robustness and environmental stability make graphene a promising material for a wide range of applications ranging from electronics to photonics. However, its true potential application will not be attained until production compatible methods are achieved.

In this talk I present CVD (chemical vapor deposition) based large-scale properties-controllable graphene synthesis. I introduce a method which controls the optical transmittance and the electrical resistance of graphene sheet using a planar mesh pattern of single and multi-layer graphenes.

I also demonstrate a flexible and transparent gas molecule sensor consisting of both graphene sensor channel and graphene heater. This combined structure leads to fully utilizing unique transparent and flexible functionalities of graphene with invariable sensing performance under a bending condition.

I introduce the progress in graphene-based photonic and plasmonic devices such as thermo-optic mode extinction modulator and planar lightwave circuit-type plasmonic photodetector for all graphene-based photonic integrated circuits (PICs). A thermo-optic (TO) mode extinction modulator based on graphene plasmonic waveguide is introduced. The graphene plasmonic waveguide is served as a light signal guiding medium with a successful 2.5 Gbps optical signal transmission at a wavelength of 1.31  $\mu\text{m}$ . A planar-type graphene plasmonic photodetector is also demonstrated with the configuration of the graphene plasmonic waveguide and photodetector structure all-in-one to detect horizontally incident light for the easy and simple integration.

### Biography:

Choon-Gi Choi received the doctorate in Physics from Université d'Orléans, France in 1996. He is currently a head of Graphene Research Center at Electronics and Telecommunications Research Institute (ETRI), Korea and a professor at the department of advanced device technology in University of Science and Technology (UST) of Korea. He is also an associate editor of the Nano Convergence with Springer publishing. From 1996 until now, he is working for the ETRI, where he has developed micro- and nano-photonic and optoelectronic devices, and graphene-based electronic and photonic devices. His current research interests are single crystal graphene synthesis, graphene-based electronic and photonic devices, metamaterial-based holographic devices, wearable and flexible devices, etc. He has authored or co-authored over 100 papers and holds over 20 U.S. patents as well as 50 Korean patents.