

Supporting Information

Fabrication of High-Performance Graphene Nanoplatelet-based Transparent Electrode via Self-Interlayer-Exfoliation Control

Jong Sik Oh^a, Ji Soo Oh^a, Da In Sung^a, and Geun Young Yeom^{*a,b}

a. School of Advanced Materials Science and Engineering, Sungkyunkwan University, 2066 Seobu-ro, Jangsan-gu, Suwon, Gyeonggi-do 16419, Republic of Korea.

E-mail: ojs2k@skku.edu

b. SKKU Advanced Institute of Nano Technology (SAINT), Sungkyunkwan University, 2066 Seobu-ro, Jangsan-gu, Suwon, Gyeonggi-do 16419, Republic of Korea.

E-mail: gyeeom@skku.edu

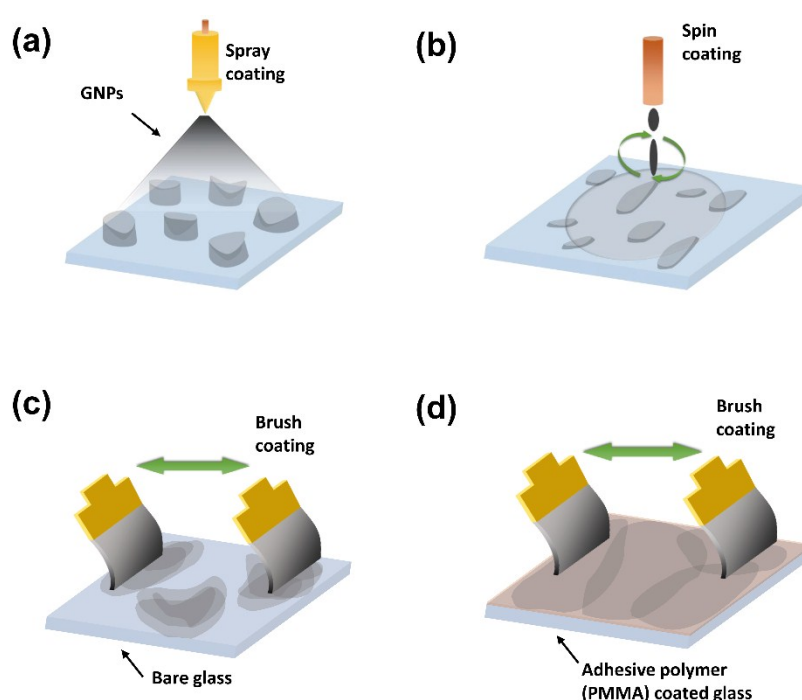


Figure S1. Schematic illustrations of various GNP coating methods. a) GNP spray-coated onto bare glass surface. b) GNP spin-coated onto bare glass surface. c) GNP brush-coated onto bare glass surface. d) brush-coating of GNP onto adhesive polymer coated glass.

For GNP coating on bare glass surface, because of weak van der Waals force between GNP and silicon dioxide, the nanoplatelet itself did not easily stick onto substrate and GNPs were agglomerated in some areas. Therefore, for spray-coating, the GNPs were not uniformly covered onto the glass surface, as shown in Fig. S1a. Fig. S1b is a diagram showing the process of expanding GNP particles horizontally using a spin-coating method in order to planarize the agglomerated or aggregated GNP. Fig. S1c and d show the brush coating process using GNP powder onto bare glass and adhesive polymer deposited glass, respectively. Adhesive polymer, such as PMMA, was used to adjust the layer thickness

of nanoplatelet and to spread the GNPs uniformly on the substrate surface while removing the excessive GNP powder on the substrate except for nanoplatelet which is directly contact with the adhesive polymer.

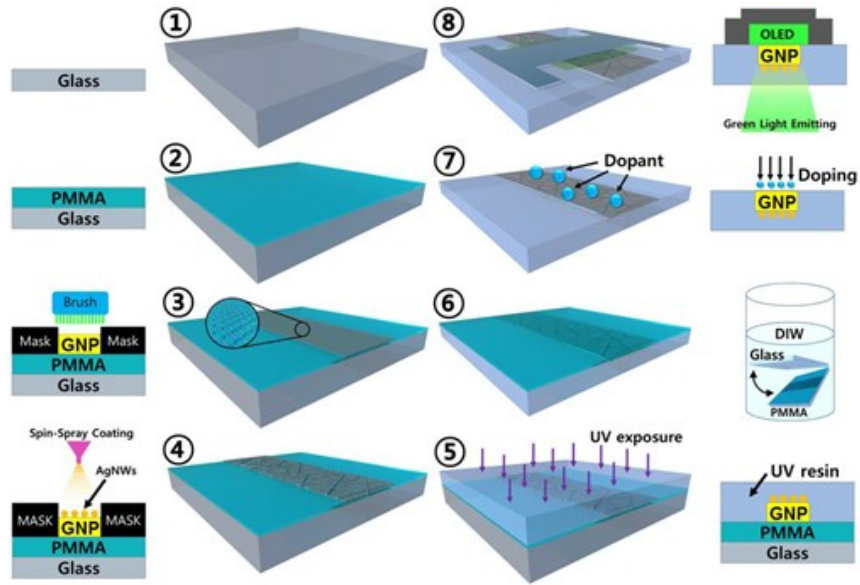


Figure S2. Details of fabrication process of GNP/AgNW-embedded flexible transparent substrate.

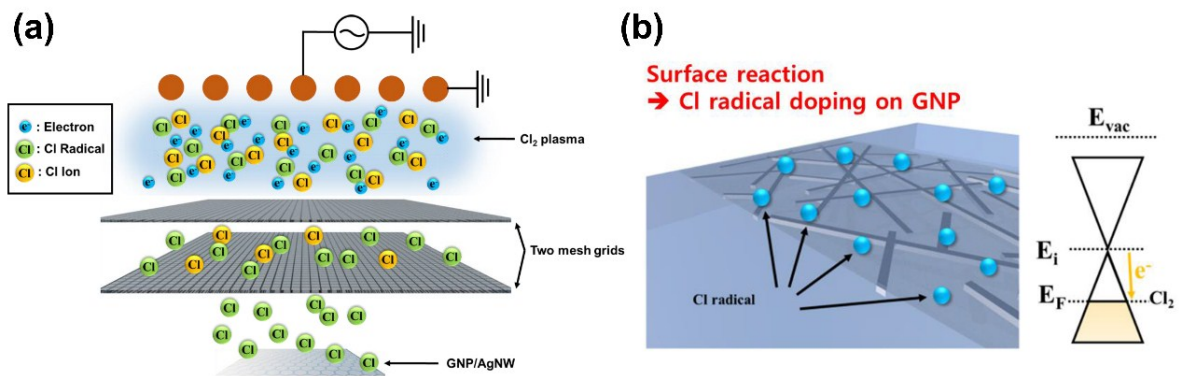


Figure S3. a) An ICP (inductively coupled plasma) source with two mesh grids used in this study for Cl₂ doping on GNP/AgNW. b) Cl₂ plasma doping mechanism on GNP/AgNW during the Cl₂ plasma generation.

For the Cl_2 plasma doping, an ICP system operated at 13.56 MHz installed with two mesh grids was used. Two mesh grids were installed between the ICP source and the substrate to remove possible damage to the GNP/AgNW hybrid electrode surface during the doping. The GNP/AgNW hybrid electrode was doped with a Cl_2 plasma for 10 s with the condition of 10 mTorr, 60 sccm, and with a radio frequency (RF) power of 20 W. The surface of the GNP/AgNW-embedded hybrid layer is covered with GNP, therefore, during the Cl_2 plasma doping, the GNP surface is chemically modified and the Fermi level is tuned to have a higher work function.