VII. Development of Scalable Processes for Graphene Materials for Sensor and Barrier Film Applications

Proposed by Yong L. Joo

Our newly devised Air-Controlled (AC) Electrospray process employs high-speed, circumferentially uniform air flow which can provide enhanced break-up and deformation of the drops and thus offer i) a much higher production rate (tens to hundreds fold), ii) a better control of dispersion of nanoinclusions in the drop, and iii) smaller drop size and better control of directing drops towards the collector with more uniform and thin coatings. In the proposed MEng project, we will develop i) cost-effective gas-sensing films for detecting carbon monoxide at room temperature and ii) flexible, transparent oxygen barrier films. To develop highly sensitive and highly selective sensors for gas molecules such as CO, NH_3, NO, we will deposit thin layers of graphene oxide (or graphene)/ZnO nanoparticle (or nanofiber) hybrid. For the development of flexible, transparent barrier films with extremely low oxygen permeability, we will coat the nanocomposites of polymer (PVA, polyimide) and small amount of graphene oxide sheets (< 1%) on a polymer film (PET, PEN), followed by an annealing process for recrystallization of polymer to interconnect graphene sheets. In both applications, AC electrospray process will be utilized to tailor the assembly of graphene oxide (or graphene) in thin films at nano and micro scales, respectively. Thorough characterization and performance of the developed gas sensors and barrier films will be carried out and samples of gas sensor films and barrier films will be sent to our collaborators for evaluation.

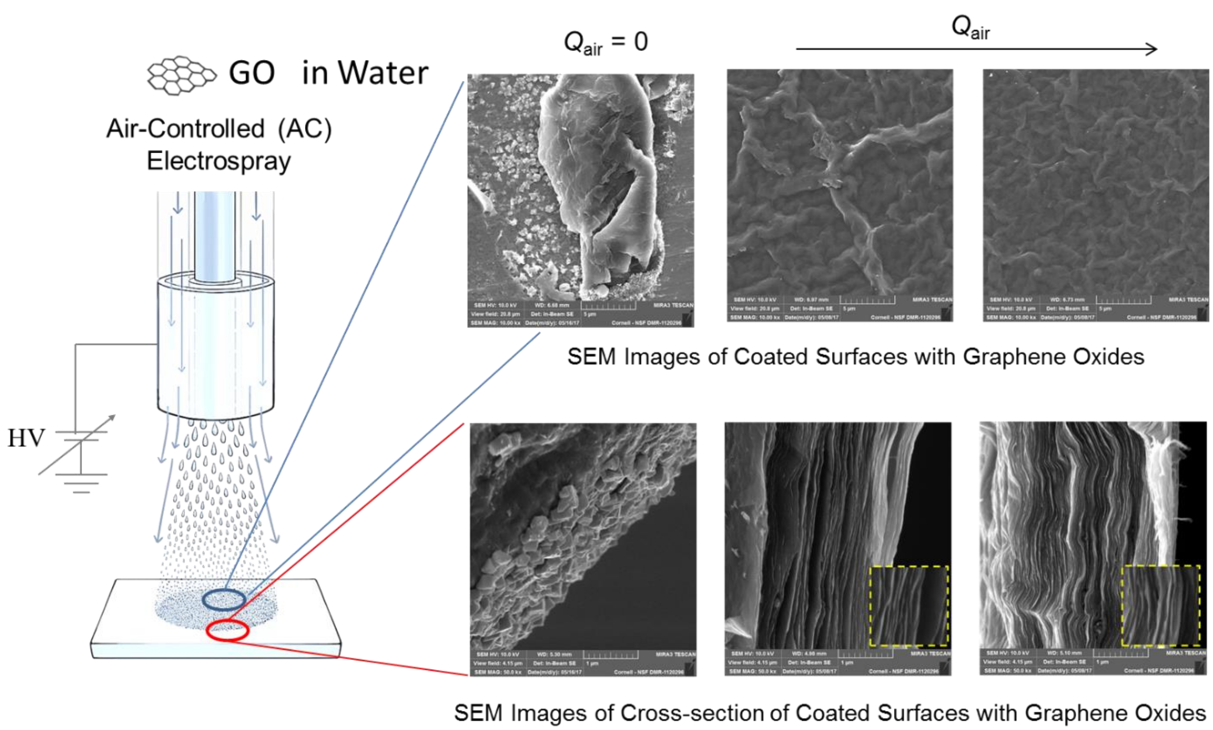

Fig. 7. *Effect of air flow in air-controlled electrospray on the layering of graphene oxide sheets as a film.*