Microplasma-assisted fabrication of GQD/Au heteronanostructures for SERS detection

Chih-Yi Fang [1], Pei-Jun Yeh [1] and Wei-Hung Chiang [1]
[1] *Department of Chemical Engineering, National Taiwan University of Science and Technology, Taipei, Taiwan*

Recently graphene quantum dot (GQD) has stimulated a lot of attentions due to their exceptional physical and chemical properties. Moreover, gold (Au) nanostructures with superior surface plasmon resonance (SPR) properties, allowing surface-enhanced Raman scattering (SERS) for an ultra-sensitive molecular-level detection. Hence, the development of GQD/AuNP heteronanostructures by sourcing various emission wavelengths of GQD with Au nanostructure can further create a rational design of active materials for high sensitive SERS detection. However, the conventional approaches to prepare such nanohybrids are usually complicated, time consuming, inefficiency, and high temperature required.

Here we demonstrate a rapid synthesis method of GQD/AuNP by using atmospheric-pressure microplasmas. Microplasmas are defined as gaseous discharges formed in electrode geometries where at least one dimension is less than 1mm, which can be operated stably with an aqueous solution at atmospheric pressure. Energetic species formed in the microplasma are capable to initiating electrochemical reactions and nucleating particles in solution without chemical reducing agents. On the basis of microscopic and spectroscopic characterizations, we suggested that energy transfer from donor (GQDs) to acceptor (AuNPs) can be the key factor to enhance the SERS properties of the as-prepared GQD/Au nanostructures.

Email: whchiang@mail.ntust.edu.tw