Scalable synthesis of graphene quantum dots by mechanochemical-assisted solid exfoliations

Hao-Hsuan Chien[1], Jun-Xiang Chen[1] and Wei-Hung Chiang[1]
[1]*Department of Chemical Engineering, National Taiwan University of Science and Technology, Taipei, Taiwan*

Graphene quantum dots (GQDs) are carbon nanocrystals with a diameter of less than 100 nm. Due to quantum confinement and edge effects, GQDs have excellent properties, including tunable PL property, good water solubility, excellent biocompatibility and easy preparation. Therefore, GQDs have been widely applied in the field of fluorescence imaging, drug delivery and photodynamic therapy. That is why GQDs have attracted an increasing attention. Mechanochemical approaches for graphene quantum dots synthesis offer the promise of new reaction pathways, and greener and more efficient syntheses, making them potential approaches for low cost production of GQDs.

Herein, we develop a facile, energy-efficient, scalable route to simultaneously prepare GQDs by high-energy ball milling a mixture of graphite and intercalation reagent. We found that the rotational speed and process time of ball milling are factors to control the yield of GQDs. Moreover, we noticed that the pH value of the intercalation reagent and the molar density of interaction ions could affect the yield of GQD. Our work provides a guide of rational and chemical formulation design of a solid exfoliation system to improve the yield of the exfoliated materials.

Email: *whchiang@mail.ntust.edu.tw*