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Highly luminescent polymer particles driven by thermally reduced graphene quantum dot surfactants HYUNSEUNG YANG, DONG JIN KANG, KANG HEE KU, HAN-HEE CHO, CHAN HO PARK, JUNHYUK LEE, DOH C. LEE, Korea Advanced Institute of Science and Technology(KAIST), PULICKEL M. AJAYAN, Rice University, BUMJOON J. KIM, Korea Advanced Institute of Science and Technology(KAIST), RICE UNIVERSITY COLLABORATION — We report the use of highly luminescent graphene quantum dots (GQDs) as efficient surfactants to produce Pickering emulsions and novel polymer particles. To generate the GQD surfactants, the surface properties of 10 nm sized, non-reduced GQDs (nGQDs), which have strong hydrophilicity, were synthesized and modified in a systematic manner by the thermal reduction of oxygen-containing groups at different treatment times. In stark contrast to the behavior of the nGQDs, thermally reduced GQDs (rGQDs) can produce highly stable Pickering emulsions of oil-in-water systems. To demonstrate the versatility of the rGQD surfactants, they were applied in a mini-emulsion polymerization system that requires nanosized surfactants to synthesize submicron-sized polystyrene particles. In addition, the use of rGQD surfactants can be extended to generating block copolymer particles with controlled nanostructures. Particularly, the polymer particles were highly luminescent, a characteristic produced by the highly fluorescent GQD surfactants, which has great potential for various applications, including bioimaging, drug delivery, and optoelectronic devices. To the best of our knowledge, this is the first report in which nanosized GQDs were used as surfactants.

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