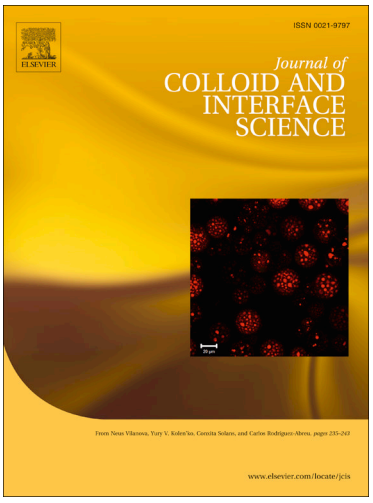
Accepted Manuscript



Liquid-phase laser ablation synthesis of graphene quantum dots from carbon nano-onions: Comparison with chemical oxidation

Rosemary L. Calabro, Dong-Sheng Yang, Doo Young Kim

PII: S0021-9797(18)30503-4
DOI: https://doi.org/10.1016/j.jcis.2018.04.113
Reference: YJCIS 23593

To appear in: *Journal of Colloid and Interface Science*

Received Date: 22 February 2018
Revised Date: 11 April 2018
Accepted Date: 28 April 2018

Please cite this article as: R.L. Calabro, D-S. Yang, D. Young Kim, Liquid-phase laser ablation synthesis of graphene quantum dots from carbon nano-onions: Comparison with chemical oxidation, *Journal of Colloid and Interface Science* (2018), doi: https://doi.org/10.1016/j.jcis.2018.04.113

Liquid-phase laser ablation synthesis of graphene quantum dots from carbon nano-onions: Comparison with chemical oxidation

Rosemary L. Calabro, Dong-Sheng Yang, *[1] and Doo Young Kim*[2]
Department of Chemistry, University of Kentucky, Lexington, KY, 40506-0055, USA

Graphene quantum dots (GQDs) have been synthesized reproducibly by chemical oxidation (CO) of carbon nano-onions (nCNOs) and a one-step pulsed laser ablation (LA) of nCNOs in deionized water. The photoluminescence (PL) spectra show that the LA-GQDs have blue shifted emission relative to the CO-GQDs which is attributed to the effects of both particle sizes and surface functional groups. The CO-GQDs have an average diameter of 4.1(8) nm and a thickness corresponding to two or three graphene layers, while the LA-GQDs have an average diameter of 1.8(6) nm and a thickness comparable to a single layer of graphene. The CO-GQDs favor the presence of carboxylic groups and have a higher fraction of sp^2 carbons, while the LA-GQDs prefer the presence of hydroxyl groups and have a higher fraction of sp^3 carbons. PL lifetime data suggests that surface functional groups are the main source of radiative deactivation and the sp^2 carbon domains are mainly responsible for non-radiative decay. PL lifetimes are measured to be 7.9(6) ns for the emission from the carboxylic groups and 3.18(10) ns from the hydroxyl groups. Compared to CO, liquid-phase LA is a faster and cleaner one-step method for producing GQDs with fewer starting chemicals and byproducts.

[1] Tel: +1 859 257-4622. E-mail: dyang0@uky.edu
[2] Tel: +1 859 257-5597. E-mail: dooyoung.kim@uky.edu