

## Facile electrochemical synthesis of triangle-shaped graphene nanoflakes and graphene quantum dots via surfactant-assisted and defect-induced mechanism

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JOURNAL OF APPLIED SCIENCE AND ENGINEERING

Volume: 25 Issue: 3 Page: 495-503

DOI: 10.6180/jase.202206\_25(3).0016

Published: 2021

Document Type: Article

### Abstract

A facile and non-hazardous route for synthesis of triangle-shaped graphene nanoflakes and graphene quantum dots (GQDs) suspension via electrochemical exfoliation has been reported. In this work, a simple electrochemical technique was employed using pristine and heated graphite electrodes under the influence of anionic surfactant, sodium dodecylbenzene sulfonate (SDBS). The synthesized graphene nanoflakes and GQDs suspension were characterized using UV-visible spectroscopy, transmission electron microscope (TEM) and Raman Spectroscopy. The UV absorption spectra showed a bathochromic shift from the typical  $\pi \rightarrow \pi^*$  transition peak which due to the introduction of oxygen groups and/or functionalization of SDBS into the graphitic layers. Morphological analyses using TEM revealed the usage of heated graphite electrodes (600 degrees C at 5 min) produced a triangle-shaped graphene nanoflakes with an average size of similar to 34 nm while the average size of the graphene nanoflakes obtained using the pristine graphite is similar to 47 nm. A possible mechanism for the exfoliation of such morphology has been proposed. The graphene nanoflakes which have size less than 10 nm from both samples can be attributed to the presence of the GQDs. Raman analysis revealed I<sub>D</sub>/I<sub>G</sub> ratio of 0.222

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expectantly pave the way towards the production of graphene nanoflakes with controlled morphology and low structural defects, which can be an efficient top-down process yet feasible for mass production.

### Keywords

**Author Keywords:** [Electrochemical](#); [exfoliation](#); [graphene nanoflakes](#); [graphene quantum dots](#); [triangle-shaped](#)

**Keywords Plus:** [HIGH-QUALITY GRAPHENE](#); [EXFOLIATION](#); [OXIDE](#); [EFFICIENT](#); [GRAPHITE](#); [ELECTROLYTES](#)

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### Categories/Classification

**Research Areas:** [Engineering](#)

### Funding

Funding agency	Grant number
Fundamental Research Grant Scheme	FRGS/1/2018/STG01/UIAM/03/2
	FRGS19-015-0623
Ministry of Higher Education (MOHE), Malaysia	

[View funding text](#)

### Document Information

**Language:** [English](#)

**Accession Number:** [WOS:000712364700016](#)

**ISSN:** [2708-9967](#)

**eISSN:** [2708-9975](#)

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JOURNAL OF APPLIED SCIENCE AND ENGINEERING

**ISSN:** 2708-9967

**eISSN:** 2708-9975

**Current Publisher:** TAMKANG UNIV, GRAD SCHOOL LANG LIT, TAMSUI, TAIPEI, TAIWAN

**Research Areas:** Engineering

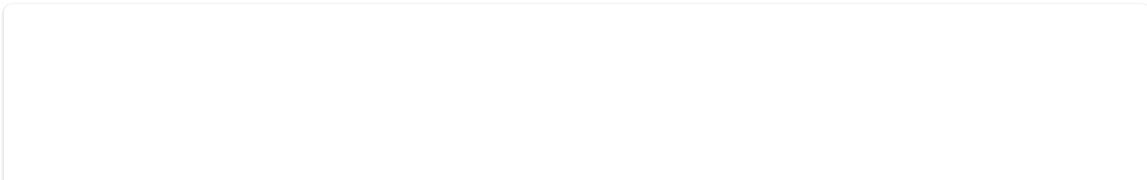
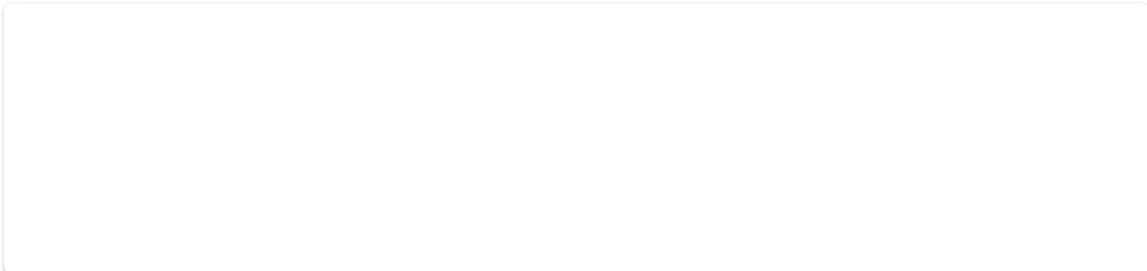
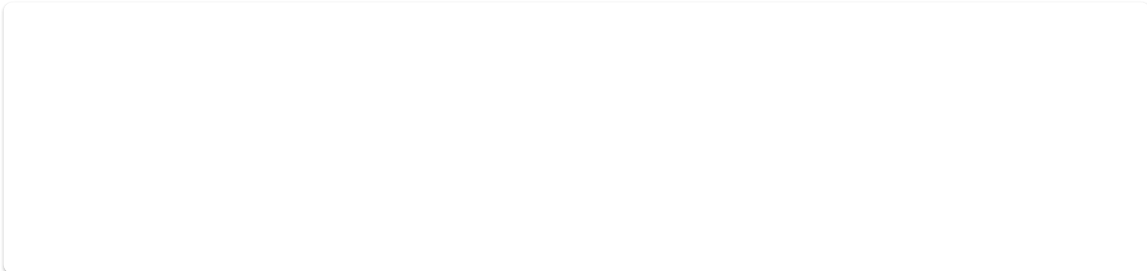
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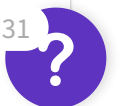
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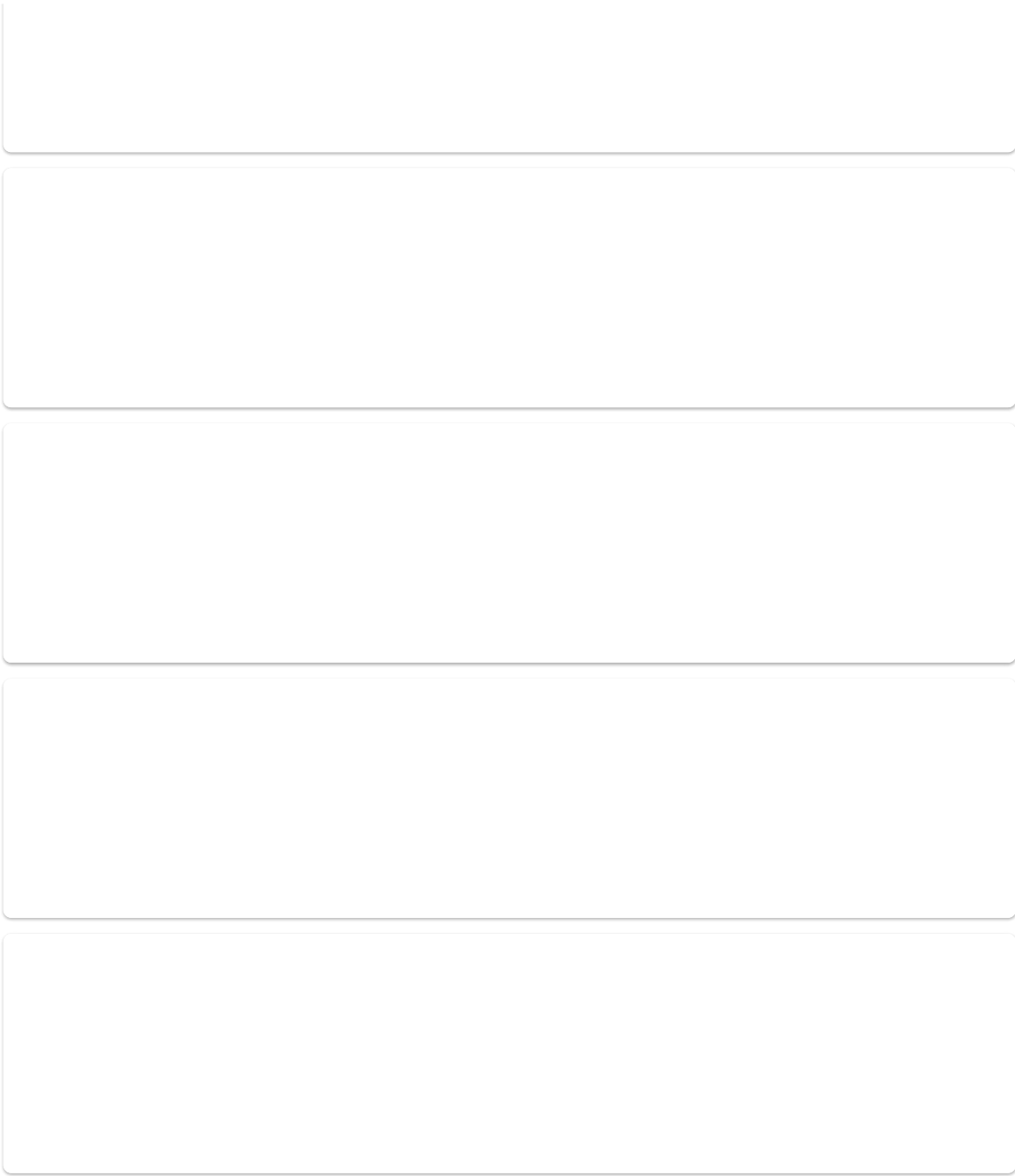
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