# Graphene/transition metal dichalcogenides hybrid supercapacitor electrode: status, challenges, and perspectives

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NANOTECHNOLOGY
**Volume:** 29 **Issue:** 50
**Article Number:** 502001
**DOI:** 10.1088/1361-6528/aae3da
**Published:** DEC 14 2018
**Document Type:** Review
View Journal Impact

## Abstract

Supercapacitors, based on fast ion transportation, are among the most promising energy storage solutions that can deliver fast charging-discharging within seconds and exhibit excellent cycling stability. The development of a good electrode material is one of the key factors in enhancing supercapacitor performance. Graphene (G), an allotrope of carbon that consists of a single layer of carbon atoms arranged in a hexagonal lattice, elicits research attention among scientists in the field of energy storage due to its remarkable properties, such as outstanding electrical conductivity, good chemical stability, and excellent mechanical behavior. Furthermore, numerous studies focus on 2D materials that are analogous to graphene as electrode supercapacitors, including transition metal dichalcogenides (TMDs). Recently, scientists and researchers are exploring TMDs because of the distinct features that make 2D TMDs highly attractive for capacitive energy storage. This study provides an overview of the structure, properties, synthesis methods, and electrochemical performance of G/TMD supercapacitors. Furthermore, the combination of G and TMDs to develop a hybrid structure may increase their energy density by introducing an asymmetric supercapacitor system. We will also discuss the future prospect of this system in the energy field.

## Keywords

**Author Keywords:** graphene; transition metal dichalcogenides; two-dimensional material; asymmetric supercapacitor; electrochemical performance

**KeyWords Plus:** LITHIUM-ION BATTERIES; HIGH-PERFORMANCE SUPERCAPACITORS; CHEMICAL-VAPOR-DEPOSITION; REDUCED GRAPHENE OXIDE; HIGH-ENERGY-DENSITY; GEL POLYMER ELECTROLYTES; MOS2 NANOSHEETS; HYDROTHERMAL SYNTHESIS; ASYMMETRIC SUPERCAPACITORS; ELECTROCHEMICAL CAPACITORS

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## Funding

| Funding Agency | Grant Number |
|---|---|
| Ministry of Higher Education, Malaysia under the Long-Term Research Grant Scheme Nanomite Project | LRGS15-003-0004 |

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### Categories / Classification

**Research Areas:** Science & Technology - Other Topics; Materials Science; Physics

**Web of Science Categories:** Nanoscience & Nanotechnology; Materials Science, Multidisciplinary; Physics, Applied

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