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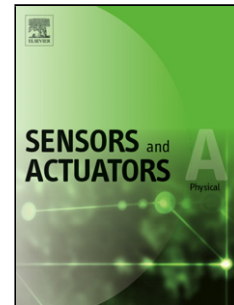
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# Graphene and its Sensor-Based Applications: A Review

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## Highlights

- Review on the fundamentals of graphene: preparation, properties and application.
- The preparation procedure Chemical Vapor Deposition, Mechanical Exfoliation and Hummer's Method.
- The applications include sensors with electrodes having graphene in its pure and nanocomposite form.
- Three types of applications namely electrochemical, strain and electrical sensors are explained, based on the operating principle of the sensors.
- The strength, limitations of the current graphene sensors along with their future opportunities.

**Abstract**— This paper presents an overview of the work done on graphene in recent years. It explains the preparation techniques, the properties of graphene related to its physio-chemical structure and some key applications. Graphene, due to its outstanding electrical, mechanical and thermal properties, has been one of the most popular choices to develop the electrodes of a sensor. It has been used in different forms including nanoparticle and oxide forms. Along with the preparation and properties of graphene, the categorization of the applications has been done based on the type of sensors. Comparisons between different research studies for each type have been made to highlight their performances. The challenges faced by the current graphene-based sensors along with some of the probable solutions and their future opportunities are also briefly explained in this paper.

**Keywords**- Graphene; Electrochemical sensors; Strain sensors; Electrical sensors; Nanocomposite.

## 1. Introduction

After the advent of smart sensors around two decades back [1], their applications in daily life have been ever increasing. Nowadays, almost every industrial, domestic and environmental sector utilizes sensors for improving the quality of life [2-7]. Among the sensorial parts, electrodes constitute the most important section as they allow the monitoring unit to receive and analyze the sensed data. Research work has been going on continuously to develop the materials used for electrodes. Existing materials have been improved based on their mechanical, electrical and thermal properties. Gold, silver, aluminum and carbon are some of the commonly used materials used to develop electrodes [8-10]. Out of them, graphene has always been a popular choice due to its distinct advantage of exhibiting excellent electrical and crystal qualities. Graphene, in simple words, can be defined as a single layer of carbon atoms that are tightly packed to form a 2D honeycomb crystal lattice structure [11].

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