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Future Photonics Devices will be Made of Carbon-based Materials: A Comparison of Electronics and Photonics

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Description

Because of its unique chemical features, including as large surface area, organised mesoporous structure, and variable pore size, mesoporous carbon-based materials have been widely used in the removal of aqueous resistant contaminants. The synthesis methodologies and features of pure mesoporous carbons, metallic modified carbons, and non-metallic functionalized carbons are introduced in this chapter using several forms of functionalized mesoporous carbon-based materials [1]. Furthermore, the applicability of the three types of mesoporous carbon-based materials in the removal of refractory pollutants is investigated and addressed in depth. Pure mesoporous carbons are mostly employed as adsorbents, catalyst activators for persulfate, and microbial fuel cell catalysts. Adsorbents, oxygen reduction reaction catalysts, and heteroatom-incorporated mesoporous carbons, mesoporous carbon immobilised enzymes and other non-metallic modified carbons are also employed [2].

Because they may be chemically coupled with other carbon-based materials and a variety of different elements to generate strong covalent bonds, carbon-based materials have shown considerable adaptability. As a result, they have outstanding properties such as great strength, density, and hardness [3]. Their research, development, and invention take place in a variety of disciplines, and studies involving the development of carbon-based materials have yielded a number of favourable findings for a wide range of structures, allowing the production of a number of materials with various applications. According to recent studies, materials based on graphene and carbon nanotubes show highly favourable results for challenges that we currently face and will face in the future if we do not prioritise research and development of new technologies to minimise and even overcome current serious environmental impacts.

In this regard, our research will focus on possible solutions to these issues, such as CO_2 reduction, H_2 photoelectrogeneration, batteries, clean energy from the oxygen reduction reaction organic pollutant degradation, and sensors. Given the wide range of potential applications for carbon-based materials, a thorough examination of their characteristics, including their synthesis and characterization, is necessary to comprehend the basis for certain properties presented by these materials and to determine their best applications. Anode electrodes made of carbon-based materials have been widely used. Carbon and graphitic carbon geometries such as a rod, plates, paper, felt, cloth, mesh, brush, and granules have all been tested. Some of these materials have a higher electrical resistance than desired due to their uneven physical structure, while others have a low specific surface area for biofilm growth or a high charge transfer resistance. Several improvements have been proposed to improve the performance of carbon materials. Anode electrodes should have a high electrical conductivity and be chemically inert [4].

Chemical and physical modifications to the surface of materials can be classified. Coverage with conducting polymers, such as polyaniline, an increase in surface chemical groups, such as ammonium or quinines, and the insertion of electroactive substances, such as, in the form of composites are just a few examples of chemical alterations. Increased porosity can be achieved by heating at high temperatures, while increased roughness can be achieved by including nanotubes. Metals or polymers with a carbon coating, solid wastes treated to prepare carbon material, and anode electrodes made completely of metallic materials are all less commonly used carbon-based materials. The type and concentration of the carbon source, as well as the bacterial community adhering to the anode material, all influence its performance [5].

Conflict of Interest

None.

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