Bi2O4/ Polyaniline Thin Films Doped with Magnesia for Multipurpose Uses: Synthesis and Applications

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One of the most difficult problems the world is currently experiencing is climate change. The long-term, localized effects of global warming are clear in the domains of politics, science, society, ethics, and economics. Renewable energy sources and energy storage devices are potential solutions for this problem. The current work highlights the role that metal oxide supercapacitors play in the creation of sustainable energy sources. This aligns with many of the Sustainable Development Goals (SDGs), such as Goal 13 (Climate Action) and Goal 7 (Affordable and Clean Energy). Metal oxide thin film is a useful tool for scientists due to its many uses in electrical device performance, environmental remediation, materials development, and transdisciplinary research. The Sol gel dip-coating method was used to create magnesium-doped bismuth oxide (Bi_2O_4) thin films for the study. The monoclinic Bi_2O_4 phase was confirmed to be present in all thin films using X-ray diffraction spectra. Using Fourier transform infrared spectroscopy; the functional bonds of bismuth oxide were verified in the range of around 460 to 580 cm^{-1}. The bandgap of undoped and Magnesia-doped Bi_2O_4 films was found to be between 2.2 and 1.97 eV. For the Magnesia: Bi_2O_4 films to be used as window layers in solar cells, this range was needed. Magnesia-doped Bi_2O_4 performs better photocatalytically than undoped Bi_2O_4, most likely as a result of better charge separation and transfer. Exposure to visible light accelerates the breakdown of organic contaminants. More investigation is needed to find the best doping concentration and investigate various approaches to improve the photocatalytic capabilities of Bi2O4. According to the study's findings, Magnesia doped Bi_2O_4 has a lot of potential uses in water purification and environmental remediation. This substance contributes to the achievement of sustainable development goals by offering a useful and affordable method of water treatment.

Keywords: bismuth oxide, sol-gel method, thin film, functional bonds, Bandgap, photocatalytic activity