**Perovskite BiFeO3: Emerging Material for Wastewater Treatment**

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This chapter delves into the promising applications of BiFeO3, a perovskite oxide, in the field of wastewater treatment. As global concerns regarding water pollution escalate, innovative solutions are imperative to address this critical issue. This chapter focuses on the unique properties and versatile characteristics of BiFeO3 that position it as a novel contender for advanced wastewater treatment processes.

The chapter begins by elucidating the fundamental properties of perovskite materials and their relevance to environmental remediation. It then delves into the synthesis methods and structural modifications of BiFeO3 to enhance its performance in pollutant removal. The multifunctional nature of BiFeO3, including its photocatalytic, adsorptive, and catalytic attributes, is explored in depth, shedding light on its efficacy in degrading a spectrum of organic pollutants, heavy metals, and even emerging contaminants.

Furthermore, the chapter critically examines the factors influencing the photocatalytic efficiency and adsorption capacity of BiFeO3, such as crystal structure, morphology, and surface area. Rare earth and transition metal substituted BiFeO3 and the integration of BiFeO3 into various hybrid nanocomposites and its synergistic effects for enhanced wastewater treatment are also discussed, highlighting the role of nanotechnology in advancing environmental remediation strategies.

Real-world applications and case studies showcase the successful utilization of BiFeO3-based materials in treating wastewater from industrial, agricultural, and municipal sources. The material's scalability, cost-effectiveness, and potential for regeneration contribute to its appeal as a sustainable solution for diverse wastewater treatment challenges.

In conclusion, "Perovskite BiFeO3: Emerging Material for Wastewater Treatment" underscores the paradigm shift toward harnessing advanced materials like BiFeO3 for tackling contemporary water pollution issues. Its comprehensive exploration of synthesis techniques, material properties, and application strategies provides valuable insights for researchers, engineers, and policymakers engaged in developing efficient and eco-friendly solutions to the global water crisis. As an emerging frontrunner in the realm of wastewater treatment, BiFeO3 holds the promise of revolutionizing the way we approach water purification and environmental conservation.

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