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A review on versatile metal vanadates photocatalysts for energy conversion and environmental remediation

Irshad Ahmad [a], Gao Li [b], Ayman Al-Qattan [c], Ahmad J. Obaidullah [d], Ahmed Mahal [e], Meitao Duan [f], Kazim Ali [f], Yazeed Yasin Ghadi [g], Ijaz Ali [h]

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Highlights

- Metal vanadates photocatalysts for fuel energy and environmental remediation are summarized
- Strategies to promote the performance of metal vanadates photocatalysts are discuss.
- Photocatalytic mechanisms involving charge transfer and separation are discussed
- The challenges and prospects in photocatalysis with V-based photocatalysts in the future are discussed

Abstract

Photocatalysis emerges as a pivotal solution amid global efforts to achieve carbon neutrality and address the pressing challenges of the worldwide energy crisis and environmental pollution. The imperative to develop exceptional photocatalysts remains central to advancing industrial applications. Metal vanadates, recognized for their cost-effectiveness, robust redox capacity, eco-friendliness, and stability, have garnered extensive attention for photocatalytic applications. However, their efficacy is hampered by the rapid recombination loss of photoinduced electron-hole pairs, hindering their industrial viability. In response to this challenge, considerable research efforts have been directed toward modifying metal vanadates through various strategies. This comprehensive review delineates diverse approaches, including doping, co-catalyst loading, defects engineering, heterojunction formation, pore texture tailoring, phase engineering, and nanocarbon loading for optimizing metal (Bi, Cu, Fe, Ni, Zn, etc.) vanadates. Moreover, it explores key charge transfer mechanisms proposed to enhance photoactivity, motivated by the global imperative to achieve carbon neutrality. The review aims to inspire further research for the rational design of V-based photocatalysts, thereby facilitating the development of exceptional catalysts for diverse photocatalytic applications. Finally, prospects and potential challenges for metal vanadate photocatalysts are deliberated.