

Towards the robust hydrogen (H₂) fuel production with niobium complexes-A review

ABSTRACT

Hydrogen is an important aspirant for the substitution of fossil fuels in future because of its net zero emissions of carbon dioxide. Escalating the green hydrogen will be vital for assisting worldwide economies with accomplishing net zero emissions by 2050 and limiting the global temperature ascends to 1.5 °C. Hydrogen fuel may provide reliable long-term solution for clean energy transition. Semiconductor materials have great potential in harvesting solar energy and improved charge separation ability. In recent years, efforts have been put by the researchers to develop niobium-based photocatalyst for H₂ production through water splitting. An enormous assortment of niobium complexes shows an appropriate electronic properties and morphological structure for enhanced photocatalytic performance. It is therefore important to explore suitable light harvesting properties having appropriate structures of photocatalyst. In this review, recent progress in niobium-based photocatalyst, novel structures and factors influencing the photocatalytic efficiencies for hydrogen production are extensively studied. The mechanism and principles of catalyst are discussed and the main group of niobium-based photo-catalyst namely perovskite niobates, niobium pentoxide complexes, aurivillius niobates, dye doped niobates are introduced. Attention has been paid to photocatalyst design with more detail on synthesis procedures which can provide the scientific community for better design of photocatalyst towards hydrogen production. Finally, emergent research trends and perspectives for photocatalytic water splitting are also suggested. The technological advancement of niobium-complexes for hydrogen generation through water splitting is believed to significantly promote the clean and affordable energy production in practice.