Cobalt Oxide nanomaterial over MoS2 quantum dots as a heterojunction photocatalyst for water splitting.

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Abstract:

Modern technological era demands for energy, and we are running short of conventional sources. Newer ways to support the energy demand is to be discovered. Hydrogen is a promising energy source with the use in local commuting vehicles (HICEV), liquid propellent rockets, and fuels cells. Until 2022 approximately 95% hydrogen is produced from stream reforming of fossil fuels or oxidation of methane [1].

In our study we have designed a Surface Plasmon Resonance (SPR) enhanced cobalt tetraoxide (Co_3O_4) photocatalyst to achieve water splitting reaction to produce hydrogen and oxygen. Cobalt tetraoxide has been well established in the semiconductor industry and is actively researched as a photocatalyst due to its enormous active sites, stability, and band gap tunability by tuning the synthesis process [2]. Our research focuses on synthesising Cobalt tetraoxide using a rapid, microwave irradiation technique.

We also introduced SPR effect on the Co_3O_4 by incorporating Molybdenum disulfate quantum dots (MoS_2QD) to enhance Cobalt tetraoxide light absorption in order to further improve the water splitting efficiency. Finally, the SPR-Co3O4 will be integrated with a microfiltration membrane for continuous filtration and photocatalysis to further analyse the performance of Co_3O_4 standalone and SPR induced Co_3O_4/ MoS_2QD using gas chromatograph for Hydrogen and Oxygen detection.

In fig. 1a, the reducer concentration (PVA and NaOH) affects the light absorbance for a fixed synthesis temperature. The reason to this is the change in morphology of the Cobalt tetraoxide. Fig. 1 (b) also demonstrates that, keeping reducer concentration same but change in synthesis temperature affects the light absorbance. 200°C-1,1.5 PVA is observed optimal synthesis temperature for Co_3O_4. So, both reducer and temperature is governing parameters for Co_3O_4 performance.

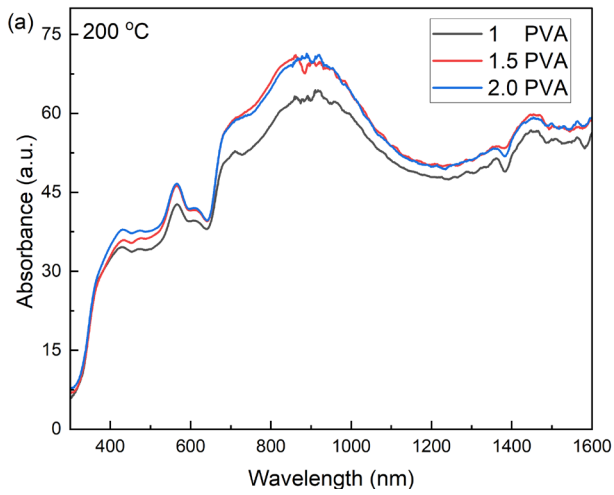

Fig. 1 (a) UV-ViS-NIR spectra for dif. 1.5 PVA and constant temp

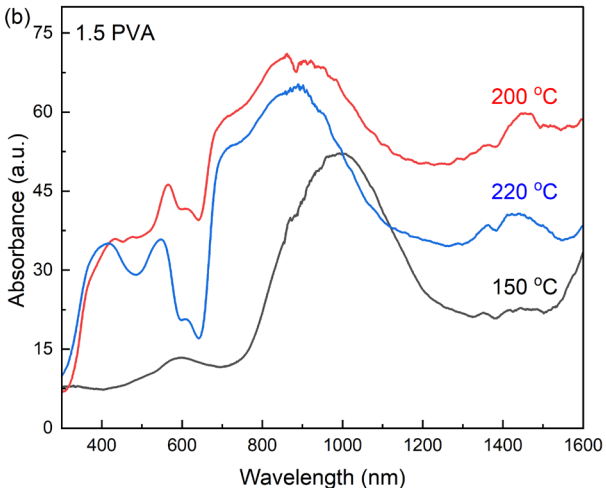

Fig. 1 (b) UV-Vis-NIR spectra for 1.5 PVA dif. Synthesis temp.

Keywords: Water splitting, Hydrogen, Oxygen, Cobalt Oxide Photocatalyst.

Reference

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