SOLAR THERMOCHEMICAL H_2 PRODUCTION VIA WATER-SPLITTING REACTION

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ABSTRACT

H_2 has emerged as an attractive cleaner and sustainable fuel and considered as the most promising future energy carrier. Harnessing solar radiation and its effective conversion to an H_2 energy carrier from an abundant source such as water will be extremely beneficial. One of the green ways of producing H_2 is by a thermochemical water-splitting reaction, which utilizes redox materials (e.g. ferrites) for the H_2 generation. This process constitutes a two-step approach. In the first step the ferrite material reacts with water and produces H_2 at lower temperatures (exothermic reaction) and in the second step the reacted ferrite material is regenerated at higher temperatures (endothermic reaction). This investigation reports the synthesis of several ferrite materials with nanoparticle porous morphology using a sol-gel technique and their characterization using powdered x-ray diffraction, BET specific surface area analyzer, and scanning and transmission electron microscopy. The H_2 generation ability of these synthesized ferrites was examined by performing multiple thermochemical cycles using a high temperature thermochemical water-splitting tubular reactor set-up at various experimental conditions. The synthesis of ferrites using the sol-gel method, characterization of the sol-gel derived ferrites, and the transient H_2 generation profiles obtained during multiple thermochemical cycles will be presented in detail.