Development of nanostructured α-Fe_2O_3 thin film for the water photo-oxidation: insights for nanoarchitecture design

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Based on the pioneer work of Fujishima and Honda's [1], worldwide research has been focused on the conversion of sunlight into hydrogen as a clean and renewable energy source. In the classical work, the authors showed that it is possible to induce the water-splitting by light, using TiO_2 semiconductor as photoanode. However, the TiO2 present a wide band gap and hence is photoexcited by UV light only (which occupies 5% of the solar spectra). The main focus of the present research is to shift the activity of the photoanode into the visible region of the sunlight, aiming to increase the energy conversion efficiency. The iron oxide (α-Fe_2O_3 or Hematite) is a semiconductor material with a narrow band gap (approximately 2.2 eV) and very good electrochemical stability in water. These properties make this material especially attractive to be used as photoanode to split the water into oxygen and hydrogen by sunlight. Theoretical calculation suggests that this semiconductor presents a maximum efficiency of 12.9%, however the reported water splitting efficiency for α-Fe_2O_3 is much lower. In the present work we will discuss the recent progress reported in the literature regarding the use of semiconductors to promote the water split as well as the results obtained in our laboratory.

(1) Fujishima, A.; Honda, K.; *Nature* **1972,** (238) 37.

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