catalysts

Editorial

Nanocatalysts for Hydrogen Production

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Rising concerns about the effects of global warming and climate change have led to a search for environmentally clean and energy efficient technologies. Hydrogen is one of the most popular new types of energy, which is considered as a clean energy carrier for the future. Hydrogen is primarily produced by the steam reforming of natural gas. Other methods have also been developed, such as the gasification of coal/biomass/waste, water splitting by electrolysis, and so on. All the ways are using nanocatalysts to obtain a high efficiency of hydrogen production. The produced hydrogen can be utilized as an energy source by applying it to the fuel cells.

Natural gas (Methane) is currently the primary source of catalytic hydrogen production, accounting for three quarters of the annual global dedicated hydrogen production (about 70 M tons). Chen et al. reviewed the major descriptors of catalyst and reaction engineering of the steam methane reforming (SMR) process and compared the SMR process with its derivative technologies, such as dry reforming with CO_2 (DRM), partial oxidation with O_2, autothermal reforming with H_2O and O_2. They have also discussed the new progresses of methane conversion: direct decomposition to hydrogen and solid carbon and selective oxidation in mild conditions to hydrogen containing liquid organics (i.e., methanol, formic acid, and acetic acid), which serve as alternative hydrogen carriers [1]. Kim et al. introduced Ni-based spinel catalyst for SMR, which is prepared through evaporation-induced self-assembly method followed by the incipient wetness impregnation of Ni. They have optimized the Mg content to suppress the coke formation by enhancing the basicity of the catalyst in the SMR reaction [2]. Sangsong et al. reported a novel dual Ni-based catalyst for a continuous combined steam and CO_2 reforming of methane (CSCRM) and ultra-high-temperature water-gas shift (UHT-WGS) reaction in the single reactor. They have proved that this dual catalyst and combined reactor system are more compact, enhances energy efficiency, and thus decreases the capital cost compared to reformers connecting with shift reactors [3].

The studies about the hydrogen production from diverse resources are also catching the spotlight. Hydrogen evolution reactions from sodium borohydride ($NaBH_4$) using silver nanoparticle networks (AgNPNs) was reported by Huff et al. [4]. Propane dehydrogenation (PDH) was introduced as a hydrogen production method in conventional petroleum refinery processes. Choi et al. reported Pt-Sn/Al_2O_3 catalysts with the regeneration after coke burning [5]. CO_2 methanation process, which is a popular power to gas (P2G) technology, was introduced, using a Ni/γ-Al_2O_3 catalysts prepared by the one-step melt-infiltration method [6]. Hydrocarbon fuel reforming has been proven useful for producing hydrogen that is utilized on road vehicles, but it is associated with reaction mechanism and catalyst characterization. Pt/Rh three-way catalyst (TWC) is adopted to investigate the effects of the reaction conditions on H_2 and CO concentrations. [7]. Jeon et al. utilized the light cycle oil as a feedstock for hydrogen production. They have applied autothermal reforming (ATR) using perovskite catalysts [8]. The hydrogen production from waste has introduced, using Co-CeO_2 catalysts which are prepared in diverse methods [9].

Summarizing, the present special issue encompasses state-of-the-art approaches to dealing with the pending questions in nanocatalysts for hydrogen production from various catalytic reactions and feedstock. The guest editor would like to express his gratitude to both the editorial team for professional assistance and all the authors for their valuable scientific contributions.

Conflicts of Interest: The author declares no conflict of interest.

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