289ai Catalytic Decomposition of Sulfur Trioxide with Metallic Catalysts for the Is Cycle of Thermochemical Hydrogen Production

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Iodine-Sulfur (IS) thermochemical process is one promising method for hydrogen production by thermochemically splitting water at high temperature. It has been focused as a carbon-free hydrogen production process to overcome the global warming problem and positively expected for industrialization. The IS process is a continuous and closed-cycle system consisting of three steps; (i) Bunsen reaction ($I_2 + SO_2 + 2H_2O = 2HI + H_2SO_4$; 293-373 K), (ii) HI decomposition ($2HI = H_2 + I_2$; 473-973 K), (iii) H_2SO_4 decomposition ($H_2SO_4 = H_2O + SO_3 \rightarrow H_2O + SO_2 + 0.5O_2$; 1073-1173K). Among these, the catalytic decomposition of SO_3 to SO_2 and O_2 is a key reaction using the highest temperature generated from VHTR (very high temperature gas-cooled nuclear reactor). In this work, various metallic catalysts supported on Al_2O_3 or TiO_2 were prepared in various metal contents, and the catalytic activity and thermal durability of each catalyst were compared at the temperature range of 750-950°C in a fixed bed reactor. Concentrated analyses with Fe catalysts were performed since Fe on Al_2O_3 or TiO_2 showed interestingly high performance and thermal resistance.