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Application of Commercial Sorbent into Coal-derived Syngas Desulfurization Field for Clean Coal Technologies Development

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Abstract

In order to make diversified utilization of energy and higher economic effectiveness for applications, the crude gas produced from carbonaceous solid fuels (coal, biomass, waste, etc.) needs clean-up system for subsequent utilization in IGCC (Integrated Gasification Combined-Cycle) power generation technology, poly- generation, or CCUS (Carbon Capture, Use and Storage). Sulfur compounds pollution has been a very serious and popular research issue to maintain the balance of ecological and economic development. Dry desulfurization technology selects an appropriate sorbent dependent on the material's physical and chemical properties like sulfur capacity and mechanical stability over multiple sorption-regeneration cycles. In this study, the physical properties of a commercial sorbent were analyzed by X-ray diffractomer (XRD), inductively-coupled plasma optical emission spectrometry (ICP-OES), scanning electron microscope (SEM) and surface area (BET) apparatus. The main components of the commercial sorbent are ZnO, CuO and alumina based on XRD characteristic. Results from the ICP-OES and BET analyses indicate, that the content of effective metal oxide reaches approximately 70% and it also has high surface area (90.7m^2/g) attributed to porous material. The commercial sorbent is used as a moderate-temperature desulfurization agent (300-600°C) for removing hydrogen sulfide from coal gas down to ppm levels in a fixed-bed reactor. Its H_2S removal seems to be promising for application in clean coal technology field. In order to achieve this objective, more tests will be conducted in the future to elucidate dependence of H_2S removal efficiency on operating conditions.