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High temperature H_2S adsorption using copper-titanate nanoparticles

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Direct desulfurization of syngas is an important measure to further increase the e ciency of IGCC systems. Solid-phase, metal oxide adsorbents which sequester the sulfur by converting to a metal sul de are the only desulfurization technology capable of withstanding the combustion temperatures present at the outlet of the gasi er. Copper oxide is of particular interest due to its favorable thermodynamics across a wide range of temperatures. Cu-ETS-2 is a copper exchange form of the sodium titanate ETS-2 and functions analogously to CuO for the conversion of into at temperatures ranging from ambient to 950 °C. e results of this study show that Cu-ETS-2 is capable of removing from to concentrations below a mass spectrometer's detection limit at temperatures as high as 950 °C. Temperature is, however, on one of the challenges facing a direct desulfurization adsorbent; high concentrations of H2 and water vapor are present in the syngas stream which can in uence the oxidation state of the metal and the e ciency of removal. In an attempt to prevent reduction of CuO, chromium was successfully used to stabilize the oxidation state of copper oxide and maintain constant adsorption capacity throughout the whole temperature range. While several studies have examined the e ect hydrogen in the feed, there are few studies exploring the in uence of water vapor on the e ciency of removal and none that explore the e ect of water vapor at elevated temperatures. is study can be considered the only study to investigate the in uence of water vapor on the desulfurization of a dilute stream at temperatures between 350 and 950 °C using copper oxide-based adsorbents. e ndings demonstrate that the presence of water vapor promotes production of resulting in faster reduction of CuO to and elemental copper, leading to less adsorption capacity. Finally, the ability of the adsorbent for regeneration and use as a multi-cycle adsorbent was investigated. e results indicate that the adsorbent is capable of regeneration for at least four times with no sign of reduction in capacity. e results also indicate that the exothermic nature of oxidation reaction results in temperatures up to ~1700 °C causing the partial melting of the quartz glass tube. However the adsorbent ca withstand such high temperatures and does not lose adsorption capacity a er the rst oxidation step. is phenomenon is due to having nano titanate ETS-2 as the support in the adsorbent.

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