

# High-temperature desulfurization by ZnO/Raney CuO absorbents

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## Abstract

Desulfurization of syngas containing H<sub>2</sub>S at high temperatures for integrated gasification combined cycle is gaining momentum as a commercially viable source of clean energy. Thus, a feasibility study for hot-gas (1% H<sub>2</sub>S) desulfurization by ZnO on skeletal Raney CuO (ZnO/R-CuO) absorbent was carried out. The degree of the hot-gas desulfurization by ZnO/R-CuO was 90.0% at 873 K and decrease to 46.5% as the temperature raised to 1073 K. The rate constant (*k*) for the desulfurization by ZnO/R-CuO at 873 K was  $8.35 \times 10^4 \text{ cm}^3/\text{min g}$  with the activation energy (*E<sub>a</sub>*) of 114.8 kJ/mol. Speciation of zinc and CuO in the ZnO/R-CuO for the hot-gas desulfurization was also studied by synchrotron X-ray absorption near edge structure (XANES) spectroscopy. Mainly Zn(II) and Cu(II) were found in the ZnO/R-CuO. By EXAFS, in the 2<sup>nd</sup> shells, a decrease of Cu-Cu bond distance in ZnO/R-CuO was observed during desulfurization. However, an increase in Zn-Zn bond distance was observed after desulfurization. It is apparent that hot-gas desulfurization by ZnO/Raney CuO absorbent is chemical feasible.

**Keywords:** Raney CuO, ZnO, hot-gas desulfurization, EXAFS.