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# Ni-Zn-based nanocomposite loaded on cordierite mullite ceramic for syngas desulfurization: Performance evaluation and regeneration studies

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**Abstract**: A series of Ni-Zn-based nanocomposites with various Ni:Zn mol ratios was prepared using a facile hydrothermal-calcination method. The Ni-Zn-based nanocomposites were characterized using XRD, FESEM, EDX and $N_2$ adsorption, indicating that all the Ni-Zn-based nanocomposites consisted of hierarchical nanostructure. The Ni-Zn-based nanocomposites were used as sorbents for desulfurization of simulated syngas. It was found that the optimum Ni:Zn mol ratio for preparing highly-regenerable sorbent was 2:5 and hence, this ratio was used to prepare the Ni-Zn-based nanocomposite loaded on cordierite mullite honeycomb (NiZn-28-HC). The characterization study revealed that the immobilized Ni-Zn-based nanostructure consisted of seaweed-like morphology with 10 μm thickness. After 5 desulfurization-regeneration cycles, the NiZn-28-HC demonstrated only a minor loss in the desulfurization performance. Investigation of the surface chemical states using XPS revealed that the marginal sorbent deactivation during repeated desulfurization-regeneration cycles was mainly due to the formation of sulfate. The influence of HCl on the desulfurization-regeneration cycle was also studied, showing that the presence of HCl can inhibit the desulfurization process due to competition reaction with sulfur compounds for sorption onto the sorbent active sites. However, it was found that HCl up to 50 ppmv has no significant influence on the performance and regenerability of the sorbent. The results indicated that the