

Constraint of the microstructure of tubular halloysite to its carrier performance

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Abstract: In this study, we have collected tubular halloysite samples from the Linfen area in Shanxi Province, the Guangyuan area in Sichuan Province, and the Danjiangkou area in Hubei Province, respectively, purified those halloysite samples through hand-picking, and then carried out studies on microstructure properties including crystalline texture, thermal stability, pore structure property, and surface site density by using XRD, TG-DSC, TEM, AFM, N₂ adsorption-desorption isotherm, acid-base titration, and CHN elemental analysis. The 8-hydroxyquinoline was used as guest molecule for investigating the effect of the microstructure of tubular halloysite on its carrier performance. The results show that the halloysite from the Linfen area in Shanxi Province has the most abundant pore structure, with the specific surface area of 72.48 m²/g and the total pore volume of 0.38 cm³/g. The halloysite from the Danjiangkou area in Hubei Province has the worst pore structure. The pH_{PZC} values of halloysite samples from Shanxi, Sichuan and Hubei provinces are 2.99, 3.13, and 4.72, respectively. The surface site densities of halloysite samples from Shanxi, Sichuan and Hubei provinces are 10.4 nm⁻², 10.0 nm⁻², and 11.3 nm⁻², respectively. The loading capacities of the 8-hydroxyquinoline by halloysite samples from Shanxi, Sichuan, Hubei provinces are 7.35%, 6.20%, and 6.02%, respectively. This order is consistent with the orders of the pore texture properties and pH_{PZC} values of halloysite samples. Therefore, we have concluded that the pore structure and the content of surface hydroxyl groups of halloysites are jointly determined the carrier performance of halloysite.

Keywords: tubular halloysite; pore structure; surface site density; carrier performance; 8-hydroxyquinoline