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Effect of hydrothermal treatment of γ-Al_2O_3 on boehmite properties

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Abstract

The effect of conditions of γ-Al_2O_3 hydrothermal treatment on the phase composition and porous system parameters of the products obtained at T = 150-200 ºC, P = 0.5-1.5 MPa and pH = 4.0-9.5 was studied. The products of γ-Al_2O_3 hydrothermal treatment in the aqueous suspension are phases of boehmite and bayerite with an admixture of gibbsite. Bayerite is formed in an amount of up to 4.9 % by weight. At T≈129-172 °C and pH = 9.5 aluminum hydroxides crystallize at the same time parallel routes by the mechanism of the dissolution of aluminum oxide and boehmite (bayerite) precipitation. Platelike crystals of boehmite are formed at pH = 4.0-9.5. At pH = 6.0-9.5 and T = 180-200 °C three-dimensional particles of the boehmite type are formed as a result of the cross-linking of plates. Phase conversion of γ-Al_2O_3 to boehmite in an amount up to 90.3-99.8 wt% in the hydrothermal condition is carried out at 190-200 °C and pH = 6.0-9.5 after 90-180 minutes and it is accompanied by a decrease in the SBET values from 207 to 26-30 m^2/g and VBET from 0.64 to 0.27-0.46 cm^3/g. Mesopores with a diameter of 3.1-9.5 nm are formed at T = 150-190 °C and pH = 4.0-7.3 due to close packing of the primary particles of boehmite with D (020) = 17.0-41.0 nm, D (120) = 12.7-31.8 nm with its concentration of ~40-60 wt %. Mesopores with a diameter of 10.2-37.0 nm are formed at T = 180-200 °C and pH = 4.0-9.5 by packing larger platelike crystals of boehmite with D (020) = 21.8-44.5 nm, D (120) = 23.1-38.4 at its concentration in the of ~60-90 wt% of mass. Pores with a diameter of 68.5-72.6 nm are formed at T = 180-200 °C and pH = 6.0-9.5 as a result of the formation of three-dimensional packets at a concentration of 90% in the samples.

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