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Hydrolysis mechanism for titania pigment from unconcentrated industrial TiOSO_4

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Using unconcentrated industrial TiOSO_4 solution as raw material, hydrolysis kinetic and mechanism was studied via the self-seeded thermal hydrolysis sulfate process. The slurries were characterized by hydrolysis yield test and the metatitanic acid samples were characterized by FT-IR, XRD, HRTEM and BET. Hydrolysis time of the first derivative curve calculated basically is agreed with experimental turn grey point time, and the calculated pre-exponential factor k_0 and the activation energy E_a were $1.40 \times 10^{18} \text{ min}^{-1}$ and 147.6 kJ/mol , respectively. And the calculated hydrolysis yield ranged from 15.5% to 17.9%, when hydrolysis reaction reached turn grey point time. The anatase structure was formed by the induction and the steric hindrance of SO_4^{2-} ions in bidentate ligand on surface of particles. The as-prepared metatitanic acid sample have a porous structure, specific surface area was $270 \text{ m}^2/\text{g}$, average pore size was 5.2 nm , fringe spacing for 0.352 nm and the anatase nuclei size ranged from approximately 2.8 nm to 5.3 nm .

Fig.1 The changing curve of hydrolysis yield at different time

Fig.2 The derivative curve of hydrolysis yield at different time

Fig.3 The curve of velocity constant at different hydrolysis temperature

Fig. 4. FT-IR patterns of metatitanic acid

Fig.5 XRD patterns of metatitanic acid

Fig.6 Nitrogen adsorption-desorption isotherms for metatitanic acid