Hydrolysis process for titanium dioxide pigment from un-concentrated industrial TiOSO₄ solution

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Hydrolysis of unenriched low concentration industrial titanyl sulfate solution affected SO₄²⁻, and obtained metatitanic acid sample predominantly amorphous component, containing a small amount of anatase crystal structure of particles, which TiO₆ octahedral distortion occurs, a-axis reduce, c-axis increases. These samples have a porous structure, having a surface area in the vicinity of 286 m²/g, smaller pore size, larger pore volume, moisture volatiliza and SO₄²⁻ decompose in metatitanic acid, drastically reduce the specific surface area, grain coalescence than grow , particle gap increases, the pore volume reduce after calcination. With prolonging hydrolysis time, the grain size is increase, and the grain growth can be divided into three stages: rapid growth phase, the transition phase and the grain growth of slow growth. Grain growth and particle aggregation have important relationship, mainly is aggregated between particles in the early, the latter mainly is ion attachment grew up in the particle surface. The obtained metatitanic acid particles via hydrolysis is with the size of 1-2 μm. After 70 °C drying, metatitanic acid powder with size of 0.2-1.2 μm, and average size of 583nm. And the particle size of metatitanic acid is affected by the content of colloidal particles, primary particles size and grinding intensity.

Fig.1 The curve of crystal size for metatitanic acid at different hydrolysis time

Fig.2 XRD patterns of metatitanic acid at different hydrolysis time

Fig.3 Schematic diagram of hydrolysis process of TiOSO₄ solution

Fig.4 Process of particle aggregation and precipitation

Rutile

Anatase

Brookite

Fig.5 The diagram of TiO₆ octahedral arrangements in TiO₂