Particle size distribution characterization conditions for metatitanic acid by photon correlation spectroscopy

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The particle size and its distribution of metatitanic acid determines the particle size distribution and pigment properties of titanium dioxide pigment, it is great important to characterize the particle size distribution of metatitanic acid particles. Using metatitanic acid slurry hydrolyzed from industrial low concentration titanyl sulfate solution via short sulfate process as research object, the effects of dispersing media, dispersant and dispersing conditions on the particle size distribution by photon correlation spectroscopy were investigated. Proper dispersion media, dispersant and its concentration, ultrasonic vibration would all improve the Zeta potential of metatitanic acid particles, enhance the repulsion between particles and strengthen particle dispersion. The optimal dispersion conditions for metatitanic acid were slurry dosage of 0.044 g, 50 ml of 0.05% aqueous sodium hexametaphosphate solution, mechanical stirring time of 2 min, ultrasonic vibration time of 5 min. After thorough dispersion, the particle size distribution of metatitanic acid must be determined immediately.

Fig.1 XRD patterns for metatitanic acid (A) and rutile TiO₂ pigment (B)

Fig.2 Effects of dispersion media on the surface Zeta potential of metatitanic acid

Table 1 Different slurry concentration of metatitanic acid on the surface Zeta potential and PSD

slurry concentration (g)	0.0103	0.0206	0.0443	0.0864	0.1280	0.2265	0.3122	0.4557
Zeta (mV)	-50.7	-47.6	-42.1	-34.8	-30.9	-20.9	-18.6	-15.9
Dav (nm)	3190	2170	1680	985	923	666	468	317
Pdi	1.000	1.000	0.459	0.016	0.836	1.000	0.372	0.144
Peak 1 D (nm)	387	563	901	974	903	534	460	349
Peak 1 W (nm)	20.4	49.0	117	152	134	85.7	76.4	97.8

Table 2 Different supersonic acting time effects on the surface potential and PSD of metatitanic acid

Supersonic time (min)	0	1	3	5	10	15	20	30
Zeta (mV)	-41.6	-42.9	-44.4	-46.8	-45.5	-45.0	-44.5	-44.2
Dav (nm)	1650	1520	1410	1240	1660	1600	1600	1580
Pdi	0.640	0.573	0.457	0.386	0.472	0.425	0.745	0.605
Peak 1 D (nm)	815	793	761	738	796	828	843	875
Peak 1 W (nm)	186	149	131	115	138	165	162	157

Fig.3 Effects of stabilization time on the particle size of metatitanic acid

Fig.4 SEM photographs of metatitanic acid and rutile TiO₂