Structures and properties of metatitanic acid on preparation rutile titanium dioxide pigment via short sulfate process

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The crystal structure, particle size distribution and impurity content of metatitanic acid had great impacts on the structures and pigment properties of rutile titanium dioxide pigment, and appropriate structure of metatitanic acid was helpful to prepare titanium dioxide with excellent pigment properties. The rutile titanium dioxide white pigment was produced via short Sulfate Process from unenriched low concentration industrial TiOSO_4 solution. In order to produce rutile TiO_2 pigment with good structures and excellent pigment properties, the crystal size of metatitanic acid should be controlled less than 8.9 nm and as close as possible to 7.9 nm, which could effectively promote the phase transformation and crystal growth of the rutile TiO_2 . The appropriate particle size distribution of metatitanic acid had obvious effects on obtaining rutile TiO_2 with narrower particle size distribution and near $0.20 \mu\text{m}$. It was best to adjust the hydrolysis conditions to reduce the specific surface area of metatitanic acid so as to reduce the iron ion impurity adsorption.

Fig.1 XRD patterns for metatitanic acid

Fig.2 XRD patterns for rutile TiO_2 pigment

Table 1 Crystallite size, rutile content and pigment properties for metatitanic acid and rutile TiO_2 pigment

Metatitanic Acid	$L_{(101)}$ (nm)	Rutile TiO_2	$X_R(\%)$	$L_{(110)}$ (nm)	TCS	SCX	Jasn
A	8.42	A1	98.5	124.2	1780	2.25	94.54
B	8.14	B1	98.8	134.1	1820	2.56	94.86
C	7.83	C1	99.1	142.4	1840	3.18	95.17
D	7.57	D1	99.4	147.6	1810	2.64	94.93
E	7.10	E1	99.9	158.3	1700	2.19	94.68
R930	/	R930	/	/	1910	3.12	94.52

Table 2 Effect of particle size distribution and impurity content of metatitanic acid on rutile TiO_2 pigment

Metatitanic Acid	D_{AV} nm	Pdi	S_{BET} m^2/g	Fe %	Rutile TiO_2	D_{AV} nm	Pdi	Wt, % (0.15~0.30 μm)	R_s %
A	1130	0.433	275	0.0042	A1	339	0.362	66.8	97.8
B	976	0.341	256	0.0022	B1	307	0.265	71.4	98.4
C	782	0.132	243	0.0012	C1	238	0.107	78.2	99.2
D	887	0.369	267	0.0034	D1	321	0.303	69.7	97.9
E	1029	0.475	282	0.0052	E1	372	0.387	64.1	97.1
R930	/	/	/	/	R930	/	/	/	100

Fig.3 SEM photographs for rutile TiO_2 pigment