Hydrolysis conditions on rutile titanium dioxide white pigment preparation via low concentration TiOSO_4 solution

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Using low concentration industrial titanyl sulfate solution as raw material, rutile titanium white pigment was prepared via the self-seeded thermal hydrolysis sulfate process. The effects of pre-adding water, feeding rate and aging time on the particle morphologies, particle size distribution and pigment properties of rutile titanium dioxide white pigment were investigated. The as-prepared samples were characterized by particle size distribution test, SEM, XPS, TEM and pigment properties test. The results showed that the optimal hydrolysis operating conditions was the pre-adding water ratio of 22 % of, the feeding rate of 8.3 r/min, and the aging time was of 30min. The obtained rutile titanium white pigment was with suitable particle size, narrow particle size distribution and good pigment properties. The effects order on the pigment performances from large to small was the pre-adding water volume ratio, the feeding rate and the aging time.

Fig.1 SEM photograph for sample 8#

Fig.2 XPS spectra for sample 8#

Table1 Pigment properties and particle size distribution for samples obtained from different pre-adding water volume ratio

Sample	pre-adding water volume ratio (%)	TCS	SCX	Jasn	D_{AV} (nm)	D_{10} (nm)	D_{50} (nm)	D_{90} (nm)
1#	18	1568	2.14	94.29	420	257	473	807
2#	20	1671	3.19	94.71	434	279	476	782
3#	22	1721	3.41	94.75	396	229	443	900
4#	24	1637	4.24	94.44	395	224	435	1082
5#	26	1450	3.82	94.51	427	283	464	722
R930	-	1910	3.12	94.52	368	248	398	594

Table2 Pigment properties and particle size distribution for samples obtained from different feeding rate

Sample	feeding rate (r/min)	TCS	SCX	Jasn	D_{AV} (nm)	D_{10} (nm)	D_{50} (nm)	D_{90} (nm)
6#	6.1	1617	2.86	93.66	424	261	474	811
7#	7.2	1663	2.89	94.12	400	269	433	659
8#	8.3	1678	2.93	94.32	414	277	447	687
9#	9.4	1627	2.65	94.39	418	277	454	707
10#	10.5	1519	3.33	94.90	421	236	480	1041
R930	-	1910	2.86	94.52	368	248	398	594

Table3 Pigment properties and particle size distribution for samples obtained from different aging time

Sample	Aging time (min)	TCS	SCX	Jasn	D_{AV} (nm)	D_{10} (nm)	D_{50} (nm)	D_{90} (nm)
11#	20	1539	2.45	94.10	411	275	445	682
12#	25	1543	2.66	94.13	411	276	444	677
13#	30	1593	2.73	94.47	392	265	422	637
14#	35	1507	3.23	94.48	376	217	419	635
15#	40	1502	2.47	94.47	415	267	454	736
R930	-	1910	3.12	94.52	368	248	398	594