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Appendices

Estimate crystal size using the Scherrer's equation

$$L = (K\lambda)/(\beta\cos\theta)$$

Where D = crystal size

λ = wavelength of the X-ray = 0.1548 nm

β = full-width at half maximum (FWHM) of (101) plane in radians

(2¶ radians= 360°, 1radians = 57.296°)

θ = diffraction angle, $2\theta = 27.5°$ for rutile; $2\theta = 25.4°$ for anatase

Synthesis yield (Y_s) of ZSM-5 zeolite

The synthesis yield is defined as the gram of calcined ZSM-5 per gram of SiO_2 and Al_2O_3 in the initial mixture.

$$Y_s\ (\%) = (\text{wt of calcined ZSM-5}) \times 100/(\text{wt of } SiO_2+Al_2O_3 \text{ in gel})$$

The apparent rate constant

$$\ln(C_0/C_t) = kt$$

where C_0 = initial concentration of solution

Ct = concentration of solution at the irradiation time

k = apparent rate constant

t = irradiation time

Absorbance data (TiO_2 powders)

Time in the dark (h)	Absorbance (at 664 nm)								
	TiO_2-1	TiO_2-2	TiO_2-3	TiO_2-4	TiO_2-5	TiO_2-6	TiO_2-7	P-25	ST-01
-3	1.4076	1.4076	1.4076	1.4076	1.4076	1.4076	1.4076	1.4076	1.4076
-2.5	1.1118	1.0508	1.2713	1.0950	1.1221	1.0869	1.2002	1.2178	1.0938
-2	1.1638	1.0972	1.2565	1.1102	1.1687	1.1495	1.194	1.1498	1.1151
-1.5	1.1707	1.0742	1.2533	1.1182	1.1298	1.1143	1.1988	1.0899	1.1011
-1	1.1671	1.0681	1.2530	1.1144	1.1158	1.1008	1.1923	1.0343	1.0856
-0.5	1.1701	1.0584	1.2448	1.1150	1.1101	1.0970	1.1884	1.0301	1.0180
0	1.1658	1.0528	1.2425	1.0141	1.0871	1.0837	1.1937	1.0213	1.0032
Irradiation time (h)									
0	1.1658	1.0528	1.2425	1.0141	1.0871	1.0837	1.1973	1.0213	1.0032
0.5	0.4782	0.7877	1.0916	0.5164	0.4415	0.1430	0.4343	0.1332	0.5824
1	0.1717	0.5415	0.9765	0.1571	0.1434	0.0817	0.2462	0.0432	0.3581
1.5	0.0977	0.3628	0.8412	0.0625	0.0537	0.0439	0.1633	0.0387	0.2068
2	0.0467	0.2013	0.7260	0.0468	0.0385	0.0388	0.1109	0.0215	0.1176
2.5	0.0395	0.1109	0.6016	0.0298	0.0203	0.0298	0.0748	0.0166	0.0772
3	0.0340	0.0604	0.5439	0.0224	0.0198	0.0140	0.0615	0.0082	0.0651
3.5	0.0247	0.0392	0.4992	0.0194	0.0176	0.0132	0.0537	0.0071	0.0589
4	0.0223	0.0218	0.4201	0.0172	0.0154	0.0098	0.0452	0.0062	0.0286

Absorbance data (TiO_2/ZSM-5 composites)

Time in the dark (h)	Absorbance (at 664 nm)					
	ZSM-5	TiO_2/ZSM-5 (wt ratio)				
		1:20	1:10	1:5	1:2.5	1:1
-3	1.4076	1.4076	1.4076	1.4076	1.4076	1.4076
-2.5	1.0111	0.8405	0.9731	0.6317	1.2670	0.0695
-2	1.0114	0.8609	1.0365	0.6888	1.3254	0.0517
-1.5	0.9966	0.8368	1.0270	0.7052	1.3129	0.0628
-1	0.9828	0.8211	1.0187	0.7236	1.3195	0.0702
-0.5	0.9801	0.8232	1.0101	0.7239	1.3186	0.0742
0	0.9767	0.8241	1.0065	0.7243	1.3225	0.0758
Irradiation time (h)						
0	0.9767	0.8241	1.0065	0.7243	1.3225	0.0758
0.5	0.9629	0.6734	0.6122	0.3183	1.2132	0.0683
1	0.9307	0.5374	0.4346	0.1930	1.0962	0.0643
1.5	0.9432	0.4462	0.3325	0.1381	0.9887	0.0657
2	0.9411	0.3690	0.2662	0.1058	0.8912	0.0640
2.5	0.9303	0.3130	0.2155	0.0702	0.7888	0.0573
3	0.9393	0.2705	0.1810	0.0668	0.6958	0.0536
3.5	0.9424	0.2373	0.1544	0.0643	0.6470	0.0520
4	0.9398	0.2059	0.1328	0.0623	0.6272	0.0511

Biography

Mr. Withaya Panpa was born in Bangkok, Thailand, in 1976. He received a bachelor degree in Materials Science in 1997 from Chulalongkorn University. Since 1997 he has been working as lecturer in Ceramic Technology Division, Department of Industrial Technology, Tepsatri Rajaphat University. In 2000, He was on leave to continue a further study at the Department of Materials Science, Chulalongkorn University and received a master degree in Ceramic Technology in 2003. During his master study, he was also a teacher assistant (TA) and his research was focused on the use of waste product to produce dental plaster. After master degree graduation, He resumed his job for a year and again continued a further study for doctoral degree in 2004. His research included the synthesis of ZSM-5 from rice husk ash and TiO_2 photocatalyst. Moreover, he worked as researcher in the research team of Associate Professor Dr. Supatra Jinawath focusing on superhydrophilic thin film, TiO_2/SiO_2 pigment and self-leveling underlayer. In 2009, he graduated and received a doctoral degree in Materials Science from Chulalongkorn University.