Morphology dependent phase transformation of platelet and rod-like γ-Al_2O_3

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In this work, we investigated the phase transformation of platelet and rod γ-Al_2O_3 by XRD, BET, HR-TEM, solid state ^{27}Al-NMR and ethanol TPD after sequential annealing in air up to 1100°C. After annealing at 1100°C, commercial γ-Al_2O_3 transformed to α-Al_2O_3 with drastic surface area reduction (initially 200m^2/g to 25m^2/g). However, platelet γ-Al_2O_3 transformed to Θ-Al_2O_3 not α-Al_2O_3 and sustained much higher surface area (60m^2/g) than commercial ones after same treatment. Rod γ-Al_2O_3 phase transformed to δ-Al_2O_3. Interestingly, platelet and rod which showed same XRD transformed to different phases. These results strongly suggest that the phase transformation can be affected also by secondary morphologies. Ethanol TPD from platelet and rod after 1100°C annealing, showed significantly different desorption profiles. These different phase transformations were also supported by solid ^{27}Al-NMR. Commercial alumina shows mostly octahedral Al^{3+} ions after 1100°C annealing, but others show even higher intensities of tetrahedral Al^{3+} ions than initial γ-Al_2O_3. Morphological changes were also confirmed by TEM. These results consistently suggest the morphology dependent phase transformations of γ-Al_2O_3 and thermal stability of platelet and rod.