Crystallization of nanoporous silicas using a sintering agent

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Nanoporous silicas, MCM-[n], SBA-[n] etc. has been drawn much attention due to the unique pore size and its distribution. The nanoporous silicas consist of amorphous silica networks, which are fragile and hydrothermally unstable. The transition of amorphous silica to crystalline form occurs above 1473 K under ambient condition. The structure of nanoporous silicas however collapses readily at 1273 K. Na^+, Ca^{2+} etc have been known as sintering agents for silica. In the present work, the alkari metal ion has been utilized as a sintering agent or co-additive for the enhanced crystallization of amorphous network of the nanoporous silicas. Incorporation of $NaNO_3$ enhanced the transition of the MCM-48 to the crystalline SiO2 form when it was heated even at 823 K under ambient condition. The nanoporous structure also disappeared due to the excessive crystallization. The 0.1 mol% $NaNO_3$ was sufficient to induce the crystallization at such a low temperature. The incorporation of $NaNO_3$ to SBA-15 of a thick pore wall also caused the lower crystallization temperature. The hydrothermal stability of the nanoporous silicas before and after the crystallization with a sintering agent will be presented.