Synthesis of thermally stable $BaCO_3$/mesoporous silica core-shell particles

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Pure oxygen is necessary for a high efficiency of oxy-fuel combustion. Comparing with traditional cryogenic process and nitrogen-selective physisorption, oxygen-selective chemisorptive air separation has advantages such as reduced operation cost, extremely high selectivity and high productivity for the large-scale oxygen production. The barium oxide is highly used as an oxygen-selective chemisorbent but it is unstable at high temperature. Here, we report the design of a high-temperature-stable oxygen separation system that consists of a BaCO3 core coated with a mesoporous silica shell. Inorganic silica shells isolate the active BaO particle cores and prevent BaO becoming tacky and sintered or contaminating with other elements at high temperature. In addition, the mesopores providing direct access for oxygen to the BaO core make the air separation happen. The silica shell structure of thickness and mesoporositycan be controlled by adjusting the concentration of TEOS and CTAB. The characteristics of BaCO3/mesoporous silica core-shell particles were analysed by using SEM, TEM, powder XRD, and other spectroscopy tools.