Synthesis of ZnO particles in a quench-cooled flame reactor

The quench cooling of a flame by injection of cold air was studied in a flame reactor for the formation of ZnO particles in a premixed flame with a precursor jet. A rapid temperature drop downstream from the temperature peak is advantageous for the attainment of a large specific surface area. Computational fluid dynamics simulations were used to design a quench ring with nozzles directed slightly upward and at a small tangential angle from the direct line to the center. This novel design avoids distortion of the flow pattern below the quenching plane and effectively cools the flame immediately above. At the highest tested production rate, the specific surface area of the ZnO particles increases from 20 to 60 m²/g when quenching is employed. The particles are characterized by BET surface area measurements, TEM images, and the size distributions of particle aggregates are measured by a scanning mobility particle sizer.
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