Agglomeration of Nanoscale Particles via Spray Drying for Route to Bulk Nanostructured Materials

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Nanostructured materials possess novel mechanical, optical, and magnetic properties that are advantageous to countless applications. A method of spray drying nanoparticles, mainly oxides, has been quantitatively and scientifically evaluated for optimization of the route and its products. The pre-synthesized powders and their properties are crucial in consideration and refining the properties of a bulk component or coating. Agglomerated nanostructured powders through this spray-dry method contain inherent shape, size, and distribution that are applicable to many processes of synthesis for bulk nanostructured materials. The parameters of the spray-dry procedure were evaluated using a commercially available research model spray dryer. The effect of operating variables was experimentally observed and modified to meet the requirements for the dried product. The main thermodynamic operating variables scrutinized were feed properties, feed rate, airflow, and inlet and outlet temperatures of the closed isolated system. The inlet and outlet temperatures along with the feed rate performed the principal role in control of output requirements.

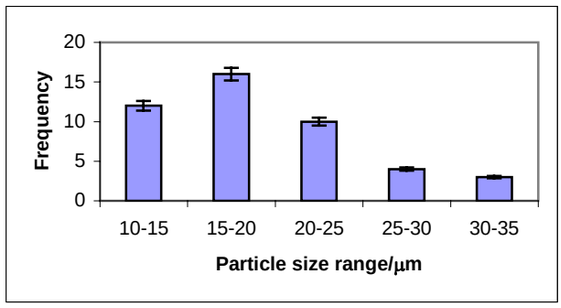

Table 1. Particle size distribution of spray dried aluminum oxide powder.

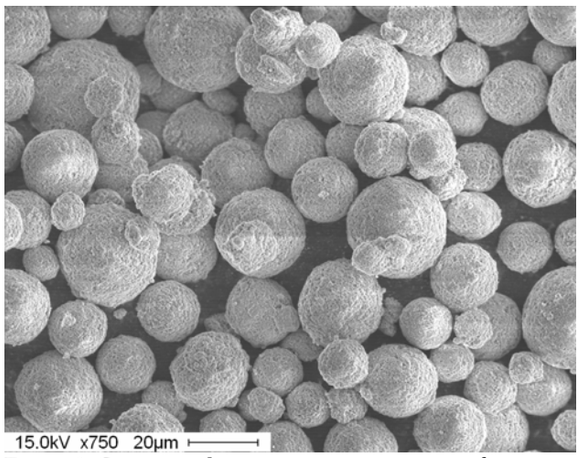

Figure 1. Scanning electron microscope image of spray-dried powder attaining spherical shape.