Particle synthesis and thermal treatment in the pulsation reactor

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The development of new materials and the optimization of existing ones has always been an important topic for science and industry. Various applications require precisely defined particle characteristics. Different processes for particle synthesis have been developed to achieve characteristics of desired shapes, compositions and size distributions. The most common processes for particle synthesis are milling, chemical liquid phase and thermal gas phase technologies. Thermal particle synthesis processes are among the most common technologies for producing materials in powder form on industrial-scale. In the field of thermal particle synthesis, flame spray pyrolysis (FSP), spray drying, hot wall reactors or fluidized bed reactors are state of the art. The beginning of research usually is the verification of theoretical considerations through laboratory experiments. After a successfully proven feasibility under certain process conditions, the first scaling step can be carried out on a pilot plant.

Limited capacities and broad research interests often makes it unattractive for research institutes to conduct these scaling experiments independently. An alternative technology for the scale-up step in such cases can be the pulsation reactor (PR), which belongs to the series of thermal treatment methods mentioned above.

The PR consists of a hot gas generator that produces a pulsating stream, i.e., fast and unsteady-state periodic combustion of natural gas in a chamber, with a resonance tube and a separator. The particles produced using this technology are thus subjected to rapid thermal treatment in the hot gas stream.

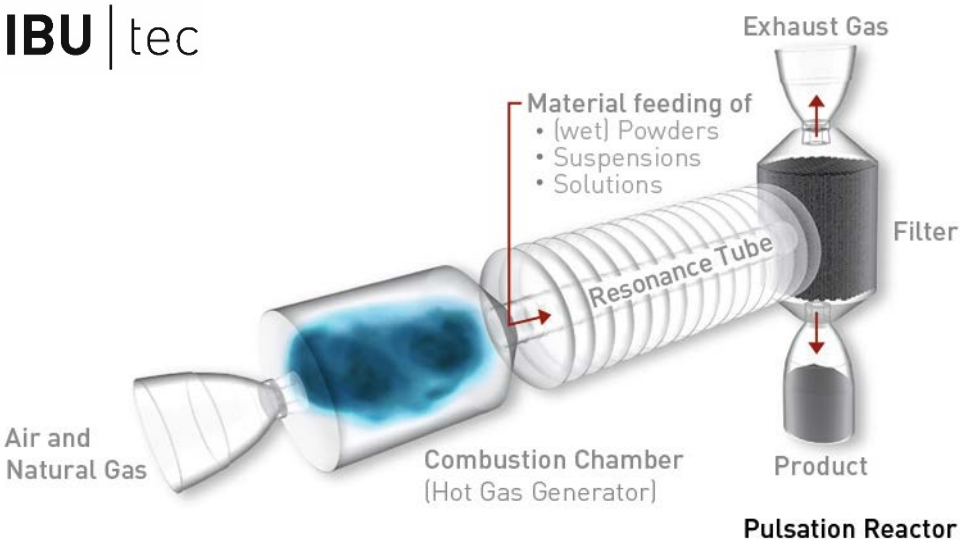

Figure 1: Pulsation Reactor

This work describes the development steps from lab-scale FSP to pilot and production scale in the PR for the synthesis of nanosized ZrO_2. A comparative study between product characteristics applying both processes (FSP and PR) is presented and discussed.