The role of sintering in process design for aerosol synthesis of nanostructured materials

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Sintering largely determines the morphology and size-structure of nanostructured materials made by gas-phase (aerosol) processes. This is crucial in manufacture of pigmentary titania, fumed silica, nanosilver and optical fibers as well as in the assembly of a number of novel sophisticated materials compositions for heterogeneous catalysis, gas sensors and biomaterials[1].

As a result, there is keen interest to establish a functional understanding of sintering and its impact on the characteristics of these materials and subsequently their performance. By now it is reasonably well understood that a multi-scale approach captures the essence of process design and scale-up for manufacturing of aerosol-made nanostructured materials. Here some examples of quantitative description of sintering of metal oxides (Si/TiO_2) and noble metals and their alloys (Ag/Au) will be elucidated by mesoscale and molecular dynamics simulations highlighting the attainment of power laws regardless of sintering mechanism and explain the “curing” of the toxicity of nanosilver by its alloys with gold.

1. G.A. Kelesidis, S.E. Pratsinis, A perspective on gas-phase synthesis of nanomaterials: process design, impact and outlook, *Chem. Eng. J.,* **421**, 129884 (2021). 10.1016/j.cej.2021.129884