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Pharmaceutical and food surfaces of relevant composite materials and the characterization thereof

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ABSTRACT

The main motivation is to understand surface-interface of materials in order to manipulate the systems and then get involved in technology. Particulate and composite materials, used in Pharmaceutical and Food, are subjected to structural modifications during the chain of steps of production and manufacturing processes. The processing objective is often to induce a macroscopic change in order to setup the material for the next processing step. One critical aspect is that the various unit operations meant to adjust the macroscopic properties that invariably induce structural changes at the microscopic scale on the materials. Being unintended, such microscopic changes are also uncontrolled and are the source of the often unpredictable and poorly understood bulk behavior of many particulate materials. It is therefore of critical relevance to develop a fundamental insight at the microscopic structure of such materials, by probing and mapping them at the nanoscale level. This study probes the interface and surfaces of stress-free and stress-induced materials with characterization thereof. Submicron particles are always produced during pharmaceutical and food processing in an uncontrolled and poorly understood manner. The high surface to volume ratio often makes them dominant on the bulk behavior of the in-process materials used for manufacturing. The structural properties controlling in-process response are size dependent, falling over the length scales ranging from nanometers to a few micrometers. In this domain, structural surface mapping is critical to the dispersion and agglomeration control to understand and enable bulk functionality of powders. Working with films has been demonstrated to be an effective way of immobilizing nanoparticulate systems in a dry and uniform manner. The use of polymer–particle composite films results in better reproducibility of in-process systems than the single component counterpart. Therefore, nanoscale mapping of surfaces of such composites results in a more systematic way of characterizing the critical processing attributes of food and pharmaceutical materials that will lead to a higher performance and acceptable shelf-life stability.