

Small-angle X-ray scattering studies of polymer powder compaction.

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Powder compaction is an important industrial process that is used for metal, ceramic and polymeric materials. Moreover, compacted tablets represent a widely used and very popular route for drug delivery. This has stimulated a considerable research effort into characterising compaction behaviour of the often complex mixtures of drugs and excipients used and the relationships with strength and swelling behaviour of the resulting tablets.

A number of mechanisms operate at the particle scale, during powder compaction. It is generally believed that particle rearrangements dominate at low pressures, while particle deformation and fracture become more important at higher relative densities, leading to greater interfacial contact and bonding between particles. However, very little direct evidence has been reported to demonstrate changes in the underlying mechanisms at different stages of compaction.

Small-angle X-ray scattering (SAXS) has been widely used to study polymer deformations, under various experimental conditions. Nevertheless, it does not appear to have been applied to powder compaction previously, even though it may be expected to provide a direct method for observing and quantifying particle deformation. This presentation will describe some recent work at Cambridge, using SAXS to investigate the deformation of polymeric powders undergoing compaction.