VISCOUS FLOW-CONTROLLED COMPACTION OF LATEX COATINGS

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During the wet stage of drying of a latex coating, the latex particles deform against each other and bulge into the pore space due to the interplay of elastic and capillary forces; as the pore throats narrow and restrict the flow out of the pore space the rate of compaction must become flow-controlled. Herein, we develop a flow-controlled deformation model that describes the non-uniform compaction of regular packings of elastic spheres. The deforming particles are approximated as constant-volume truncated spheres. The inter-particle contacts are assumed Hertzian.

As drying proceeds, two main regimes are found: one where the air invades the pore space first and one where some pore closes first. After a pore closes, the degree of uniformity of the rest of the pore throats allows to predict a region where skinning occurs. Two dimensionless parameters are best suited to construct a map of first events. One is the ratio of elastic to capillary forces; the other is the geometric mean of the ratios between elastic to viscous and capillary to viscous forces.