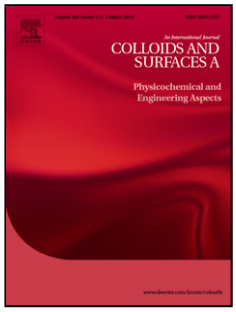

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Compressive resistance of granular-scale microgels: from loose to dense packing

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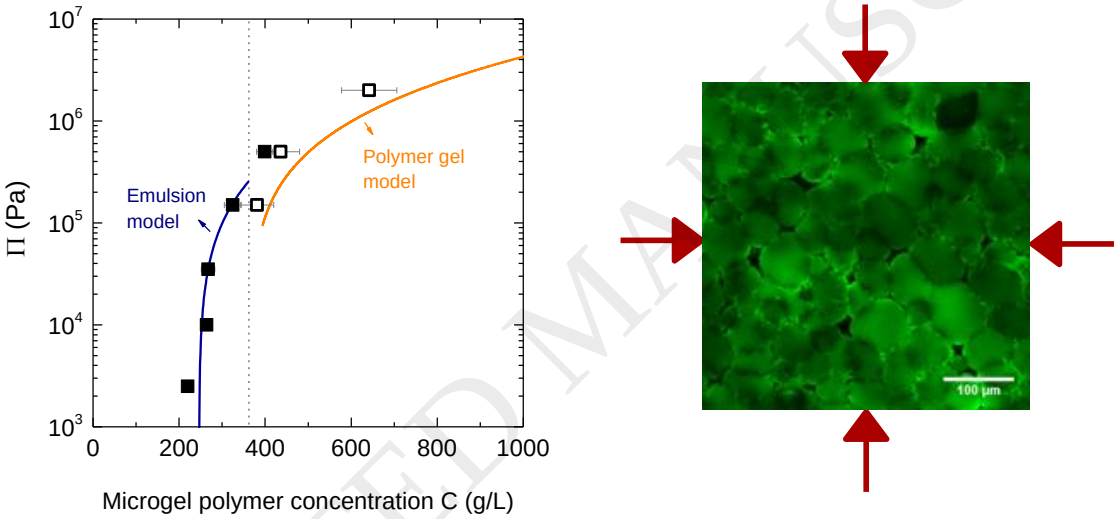
Graphical abstract



Abstract

Microgels are deformable and compressible particles that can be packed to concentrations that exceed the random close packing limit of hard spheres. For reaching high packing levels, one has to overcome the resistance to compression of the system. This resistance potentially originates from many different phenomena (thermal agitation effects, surface interactions, microgel deformation, interpenetration, water expulsion) that depend on the microgel properties (size, ionic charge, structure, softness). Here, we investigate granular-scale dextran-based microgels with different native water contents. The resistance to compression of the suspensions is measured through the variation of the osmotic pressure with packing concentration. In parallel, we characterize the structure of the packings in terms of polymer heterogeneity, microgel deformation, and average size using confocal microscopy. We find that all microgel suspensions resist compression in the same manner; however, the mechanisms involved clearly depend on the actual degree of compression. In the loose packing regime, the resistance originates mainly from the resistance of the microgels to their own deformation, with no or negligible deswelling; the osmotic