One-step generation of alginate-based hydrogel foams using CO_2 simultaneously for foaming and gelation

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The reliable generation of hydrogel foams remains an important challenge in a wide range of sectors including the biomedical[1] or food[2] sectors. Using the example of alginate-calcium carbonate foams whose gelation relies on the pH-dependent solubility of the calcium carbonate, we introduce here a novel foaming method that uses CO_2 simultaneously for foaming and for acidification of the alginate solution to trigger gelation[3]. Diffusion and dissolution of the CO_2 from the foam bubbles into the alginate solution induces an interface-driven acidification of the pre-gelling solution. This allows a good matching of the foaming and gelation timescales via tuning the CO_2 content in the foaming gas, a very important criterion for an effective "liquid foam templating"[4]. We show that using this approach, gelled foams of different relative densities can be reliably generated in a simple one-step process. We also show that interfacial rheology allows to put in evidence the interface-driven gelation. Both approaches, gas-initiated gelation and interfacial rheology for their characterization, can be transferred readily to other types of gases and formulations.

References:

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