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# Foam patterning in porous media

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## Abstract

We consider a model of patterning of one-dimensional foam-bubble chain confined in a bamboolike capillary. The discrete model of such a foam describes a distribution of foam films - lamellae that, like "bridges," span a capillary. This model is a kind of Ulam map, which admits many metastable distributions of lamellae in a bamboolike capillary as governing parameters (external pressure drop, lattice parameter, lamella tension, and gas compressibility) overcome certain barriers. In particular, some random distributions of bubble sizes over the chain are suited to solutions of the proposed discrete deterministic model. Randomization of lamella positions speaks in favor of the possibility of the glasslike patterning of foam in a bamboolike capillary. For such "chaotic" foam structures, the admissible pressure drop that the bubble chain can sustain, i.e., the so-called start-up, yield pressure drop, rises. We show that the start-up pressure drop depends upon the length of the chain nonlinearly. Only for short chains does it linearly depend upon the number of bubbles in the chain. For infinitely long chains, a saturation effect is observed; i.e., the critical pressure drop becomes independent of the chain length.