Interactions of foam with porous materials [Abstract]

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Interactions of foam with porous materials.

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In a number of applications foaming liquids are mixtures of surfactants and polymers. These mixtures frequently show a non-Newtonian power law shear thinning behaviour [1-3]. Surprisingly drainage of foams built up by non-Newtonian liquids does not attract enough attention in spite of wide use of such foams. In a number of applications foams are deposited on porous substrates: hair, skin, textile, sponges and so on, however even the basics of the interaction of Newtonian and non-Newtonian foams with porous materials have never been thoroughly investigated: there is only one publication in the area where a complex interaction of foams with porous substrates was investigated [4]. The current state of drainage of foams built up by non-Newtonian liquids and the studies on drainage kinetics will be presented. It was found [4] that the kinetics of foam drainage on a porous substrate in the case of foam built up by a Newtonian liquid depends on three dimensionless numbers related to the properties of both foam and a porous substrate, and initial liquid volume fraction inside the foam. The result showed that there are three different regimes of the drainage process from foam [4]: (a) rate of imbibition into the porous substrate is faster than the rate of drainage from the foam; (b) a comparable rate of drainage and imbibition; (c) rate of imbibition is slower as compared with the rate of drainage. In the latter case the liquid volume fraction at foam/porous substrate interface reaches maximum limiting value at the moment $t_m$ and a free liquid layer starts to form on the surface of the porous substrate. However, in the end, the free liquid layer is sucked by a porous substrate and it completely disappears at the moment $t_M$. After that moment again all liquid coming from the foam goes directly into the porous substrate and the liquid volume fraction decreases to its equilibrium value determined by properties of both foam and porous substrate.

References: