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Modeling shapes and dynamics of confined bubbles. (English summary)

Annual review of fluid mechanics. *Vol*. 38, 277–307, *Annu*. *Rev*. *Fluid Mech*., 38, *Annual Reviews, Palo Alto, CA*, 2006.

This review deals with bubbles under strong geometric constraints. Some of the recent applications of this specific topic are the problem of oil recovery from porous rocks, studies of multiphase flows in small channels, micro-fluidics, thermal ink-jet printers, etc.

This paper reviews the mathematical models of confined bubbles, emphasizing physical mechanisms as expressed in simple geometries. Molecular interactions between liquid, gas and the confining solid are all important and are described through the disjoining pressure concept. Methods for finding static shapes are considered. The static solution is a springboard for discussing pressure-driven and surface-tension-driven flows, both of which involve viscous effects and macroscopic films entrained near apparent contact lines. The vapor bubbles produced by thermal effects are discussed next. Vaporization localized near contact lines and condensation distributed in colder parts of the interface lead to steady vapor bubbles. Their size is determined through global constraints. Unsteady vapor bubbles are discussed and thoughts on open problems are then presented.

{For the entire collection see MR2206970 (2006j:76003)}

Reviewed by *P. Rochus* (Liège)