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Bubble Formation in a Quiescent Liquid RONALD SURYO, OSMAN BASARAN, School of Chemical Engineering, Purdue University, West Lafayette, IN 47907, USA — Bubble formation is important in diverse applications such as distillation, blood oxygenation, gas absorption, and glass manufacturing. Dynamics of growth and breakup of a bubble from a tube (orifice) immersed in a container filled with a quiescent incompressible, Newtonian liquid are determined computationally by finite element analysis. Simulations are carried out over a wide range of Reynolds numbers Re (inertial/viscous force), gravitational Bond numbers G (gravitational/surface tension force), capillary numbers Ca (viscous/surface tension force), and ratios of container to tube radii a. Variation of primary bubble volume and bubble length at breakup with the governing parameters are determined and rationalized to shed physical insights into the underlying physics governing bubble growth and breakup. Scaling behavior near pinch-off is also examined. The minimum radius of a necking bubble is found to scale linearly with time to breakup. As pinch-off nears, pressures in both phases remain bounded but the diverging surface tension pressure is shown to be balanced by the viscous stress exerted by the outer liquid.

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