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Dissolution without shrinking: the Epstein-Plesset problem in a channel flow SUIN SHIM, JIANDI WAN, HOWARD STONE, Princeton University — The dynamics of dissolution of CO2 bubbles in microfluidic channels is studied experimentally and theoretically. The results show first a rapid dissolution regime followed by a second apparent equilibrium regime where the bubble radius is constant. We observed that, regardless of the surfactant concentration, bubbles stopped shrinking after ∼30ms following generation. In the equilibrium regime, the bubble sizes are larger at low concentration of surfactants than at high concentrations. We interpret the results by considering the pressure variation along the microfluidic channel and modify the Epstein-Plesset model for bubble dissolution. Our modified model with a time dependent pressure term as the bubbles move along the channel explains the transient and steady behaviors of CO2 bubbles in a channel flow. In particular, the model rationalizes why the bubbles continue to dissolve even though the bubble radius is constant, since the pressure change accompanying bubble translation causes a shape change compensating the shrinkage due to dissolution.

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