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Bubble shrinkage and growth: A solution to carbon dioxide dissolution and solubility MILAD ABOLHASANI, EUGENIA KUMACHEVA, AXEL GUENTHER, University of Toronto — Dynamic and equilibrium aspects of carbon dioxide transport across gas-liquid interfaces impact a wide range of technical, physiological and geological applications. We investigate carbon dioxide transport by continuously guiding a train of uniformly sized carbon dioxide bubbles and non-saturated liquid segments through a microchannel. The bubbles initially shrink and later expand. We quantitatively link the evolution of the bubble size to kinetic and equilibrium characteristics of carbon dioxide dissolution. While the initial velocity of carbon dioxide bubbles and the length of liquid segments significantly affect the dissolution of carbon dioxide, these parameters cannot be externally imposed, due to the dynamic nature of microscale gas-liquid flows. We use an automated microfluidic platform (gas impermeable) in combination with an image-based feedback control strategy to keep the dependent parameters constant and systematically determine the rate of carbon dioxide dissolution and the equilibrium solubility of carbon dioxide-liquid mixtures for a wide range of pressures, temperatures and liquids in a flowable format.

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