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Tunable Microfluidic Bubble Generator

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We use a flow-focusing geometry incorporated in a microfluidic device to force breakup of nitrogen bubbles in an aqueous medium. We report experimental results on: i) stable formation of monodisperse bubbles, ii) independent control over the size of the bubbles and volume fraction of the dispersed phase, and iii) dynamic assembly of the bubbles into ordered arrays. We propose a quantitative description of the dynamics of breakup and propose a mechanism behind the narrow size distribution of the bubbles and droplets formed in flow-focusing devices. In a broad range of the liquid and gas pressures applied to the system we observe dynamic assembly of bubbles into highly ordered, flowing lattices. The properties of these lattices can be tuned by adjusting the flow rates of the two fluids.

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