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Confining capillary waves to control aerosol droplet size from surface acoustic wave nebulisation[1] ELIJAH NAZARZADEH, JULIEN REBOUD, RAB WILSON, JONATHAN M. COOPER, University of Glasgow — Aerosols play a significant role in targeted delivery of medication through inhalation of drugs in a droplet form to the lungs. Delivery and targeting efficiencies are mainly linked to the droplet size, leading to a high demand for devices that can produce aerosols with controlled sizes in the range of 1 to 5μm. Here we focus on enabling the control of the droplet size of a liquid sample nebulised using surface acoustic wave (SAW) generated by interdigitated transducers on a piezoelectric substrate (lithium niobate). The formation of droplets was monitored through a high-speed camera (600,000 fps) and the sizes measured using laser diffraction (Spraytec, Malvern Ltd). Results show a wide droplet size distribution (between 0.8 and 400μm), while visual observation (at fast frame rates) revealed that the large droplets (>100μm) are ejected due to large capillary waves (80 to 300μm) formed at the free surface of liquid due to leakage of acoustic radiation of the SAWs, as discussed in previous literature (Qi et al. Phys Fluids, 2008). To negate this effect, we show that a modulated structure, specifically with feature sizes, typically 200μm, prevents formation of large capillary waves by reducing the degrees of freedom of the system, enabling us to obtain a mean droplet size within the optimum range for drug delivery (<10μm).

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