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Bubble Evolution During Acoustic Droplet Vaporization ADNAN QAMAR, JOSEPH BULL, The University of Michigan — A first theoretical model of bubble evolution in Acoustic Droplet Vaporization (ADV) inside a circular microchannel is presented. This work is motivated by a novel gas embolotherapy technique, which is intended to treat cancers by occluding blood flow using gas bubbles. The intended therapy involves the injection of superheated Dodecafluoropentane (DDFP, C_5F_{12}, boiling point 29°C) droplets, each encapsulated in an albumin shell, into the blood stream. The blood circulation carries these droplets into the tumor region where high-intensity ultrasound is used to trigger ADV to form bubbles near the desired occlusion sites. The proposed model describes the rapid phase transition from highly superheated DDFP droplet to the vapor phase via a homogeneous nucleation within the DDFP droplet. For every time step the radial component of the Navier-Stokes equation is integrated from the nucleated bubble surface to the expanding boundary of the droplet with proper boundary conditions taking into account for the vaporization process. Further from the droplet boundary to the end of microchannel a modified unsteady Bernoulli equation with the head loss term is utilized. Close agreement with experimental data for all the acoustic parameters and different initial droplet sizes is obtained. The proposed model is expected to elucidate the role of different parameters involved in the complex ADV process. This work is supported by NIH grant R01EB006476.

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