SUPPLEMENTARY INFORMATION

a. The density profiles across the gas-liquid interface

For clarity, we plot the density distribution in the *x* and *y* directions in Fig.R1. Here, Fig. R1(a) is a diagram that indicates the location of the density profiles, Fig.R1(b) is the variation of the averaged density in the gas bubble as a function of the shear velocity, Fig.R1(c) is the density distribution along the *y*-direction at *x*=100.5Å and *z*=49.5Å, which is mentioned in our manuscript, and Fig.R1(d) is the density distribution along the *x*-direction at *y*=7.5Å and *z*=49.5Å. It is clearly seen that the gas density is nearly constant in the gas bubble not only along the *x*-direction but also along the *y*-direction. To estimate the deviation of the average gas density caused by the increase in shear, we further extracted the average gas density for U_x= 5m/s， 10m/s， 15m/s， 20m/s. As shown in Fig.R1 (b), the average gas density increases with the increasing shear, the maximum of the increase in gas density is about 0.0018.

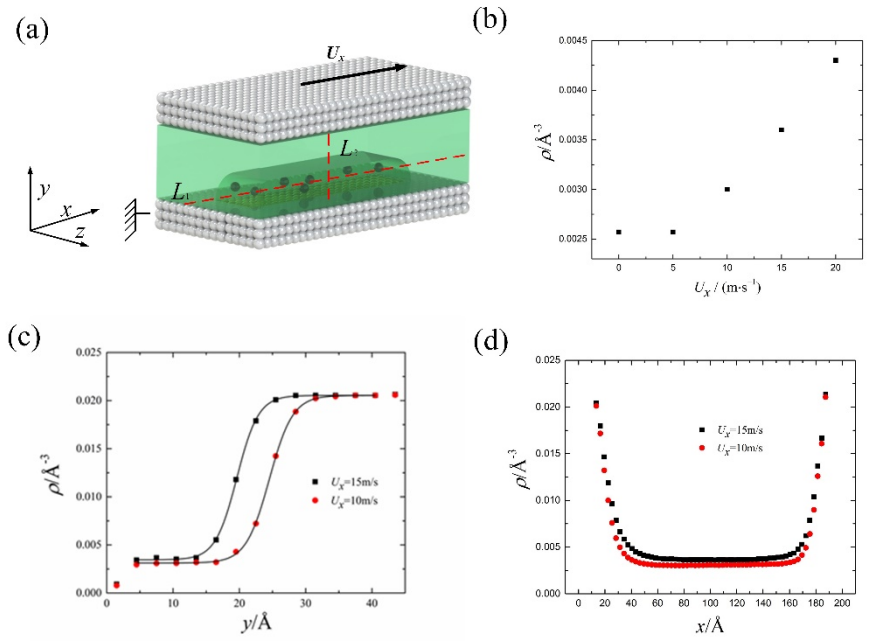

Fig.R1 The density profiles across the gas-liquid interface. (a) A diagram showing the location of the density profiles in the simulation cell. (b) The variation of the averaged density in the gas bubble as a function of the shear velocity. (c) The density distributions along the *y*-direction at *x*=100.5Å and *z*=49.5Å. (d) The density distributions along the *x*-direction at *y*=7.5Å and *z*=49.5Å.