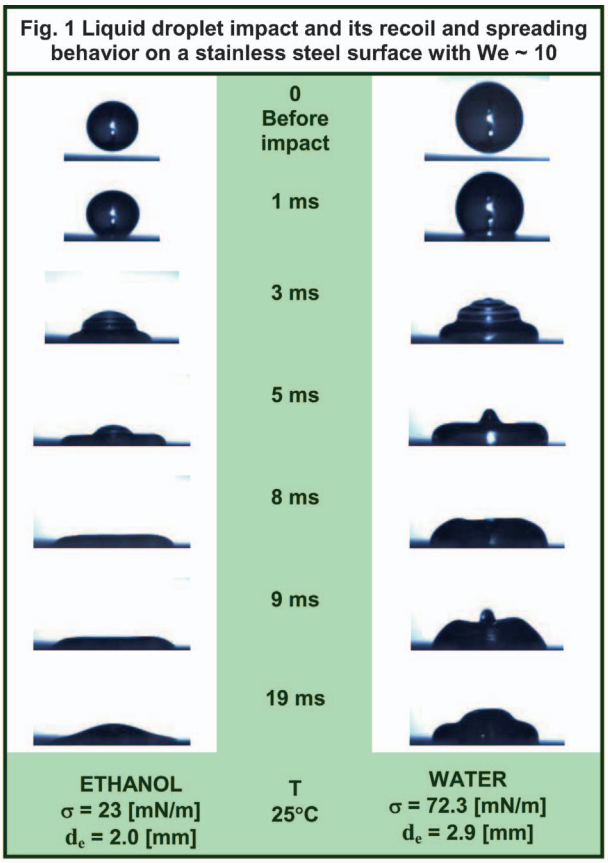

Fig. 1 Liquid droplet impact and its recoil and spreading behavior on a stainless steel surface with We ~ 10

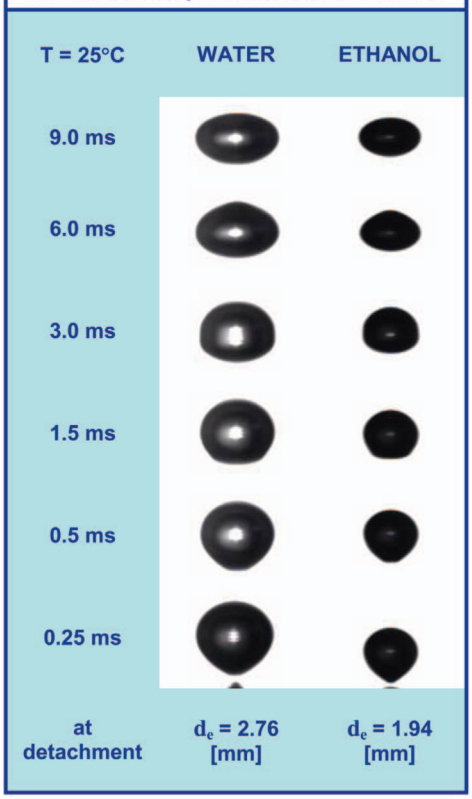

Fig. 3 Post-departure adiabatic air-bubble translation in a pool of water and ethanol

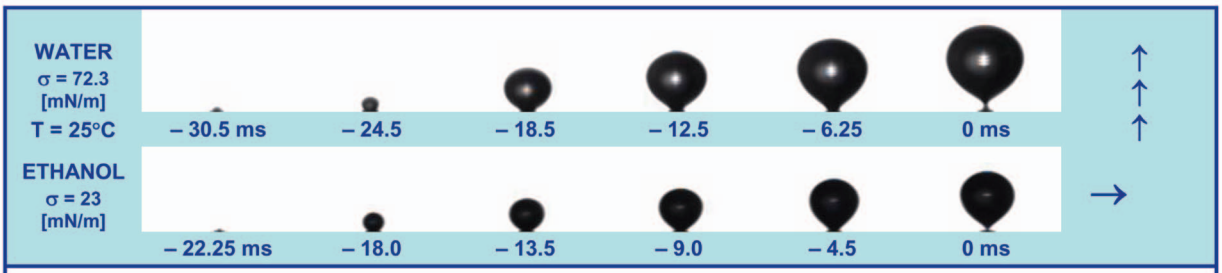

Fig. 2 Spatial-temporal evolution of an adiabatic air bubble in a pool of water and ethanol

MILI-SCALE VISUALIZATION OF BUBBLE GROWTH-TRANSLATION AND DROPLET IMPACT DYNAMICS

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The dynamic behavior of an air bubble, emanating from a 0.32 mm i.d., 0.64 mm o.d., vertical capillary-tube orifice with a bubble interval of 0.22 – 0.28 s at constant pressure and adiabatic (T = 25°C) conditions, as well as droplet impact and spreading on a hydrophobic surface are characterized. Images of the mili-scale spatial-temporal evolution of bubbles (embryonic appearance at orifice tip → growth and detachment → translation) as well as droplets were acquired using a high-speed (5000 frames/s) digital video camera fitted with a 8× optical zoom lens. It was triggered through a computer interface to record continuous high-speed video from which any desired frame can be captured by digital-video-processing software; the equivalent departure diameter was estimated by area-averaging using image processing software.

The impact, spreading, and recoil behaviors of ethanol and water droplets on a horizontal stainless steel surface are depicted in Fig. 1. For constant Weber number (We ~ 10), the spreading and recoil dynamics in the two cases are significantly different. Higher wettability of ethanol promotes greater spreading and dampens recoil in comparison with that seen in water. Figure 2 depicts the growth of an air bubble in pools of ethanol and water. While displaying similar ebullience, a bubble of smaller size and surface age is produced in low-surface-tension ethanol. Dynamic shape variations of the air bubble as it translates upwards in the pool are seen in Fig. 3. From a nearly spherical, tear-drop bubble, the shape changes to an oblate ellipsoid during translation, and surface tension effects are manifest only in the size of respective bubbles.

