



# Wettability of a Vibrating Surface

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## ABSTRACT

A water droplet in contact with a solid surface gets an equilibrium shape that depends on its wettability, that is, the interaction between the three interfaces involved; solid-liquid, liquid-vapor and solid-vapor. We have found that if the surface vibrates vertically, the water droplet increases its wettability on the solid surface. In other words, the droplet changes its equilibrium shape keeping its constant volume. In this research, we have studied the wettability behavior of a droplet on a vibrating surface. We have recorded the time evolution of the radius and contact angle of a water droplet. Using imaging analysis, we establish the dynamical behavior of the droplet on the vibrating surface. For this task, we have as input variables the vibrating amplitude, the vibration frequency and droplet volume. The images have been collected with a high-speed camera. Experimental results show that the droplet spreading of the droplet increases as increase as vibration amplitude. We think this is due to a positive balance of the capillary force between the successive expansions and contractions of the water droplet.

## SETUP

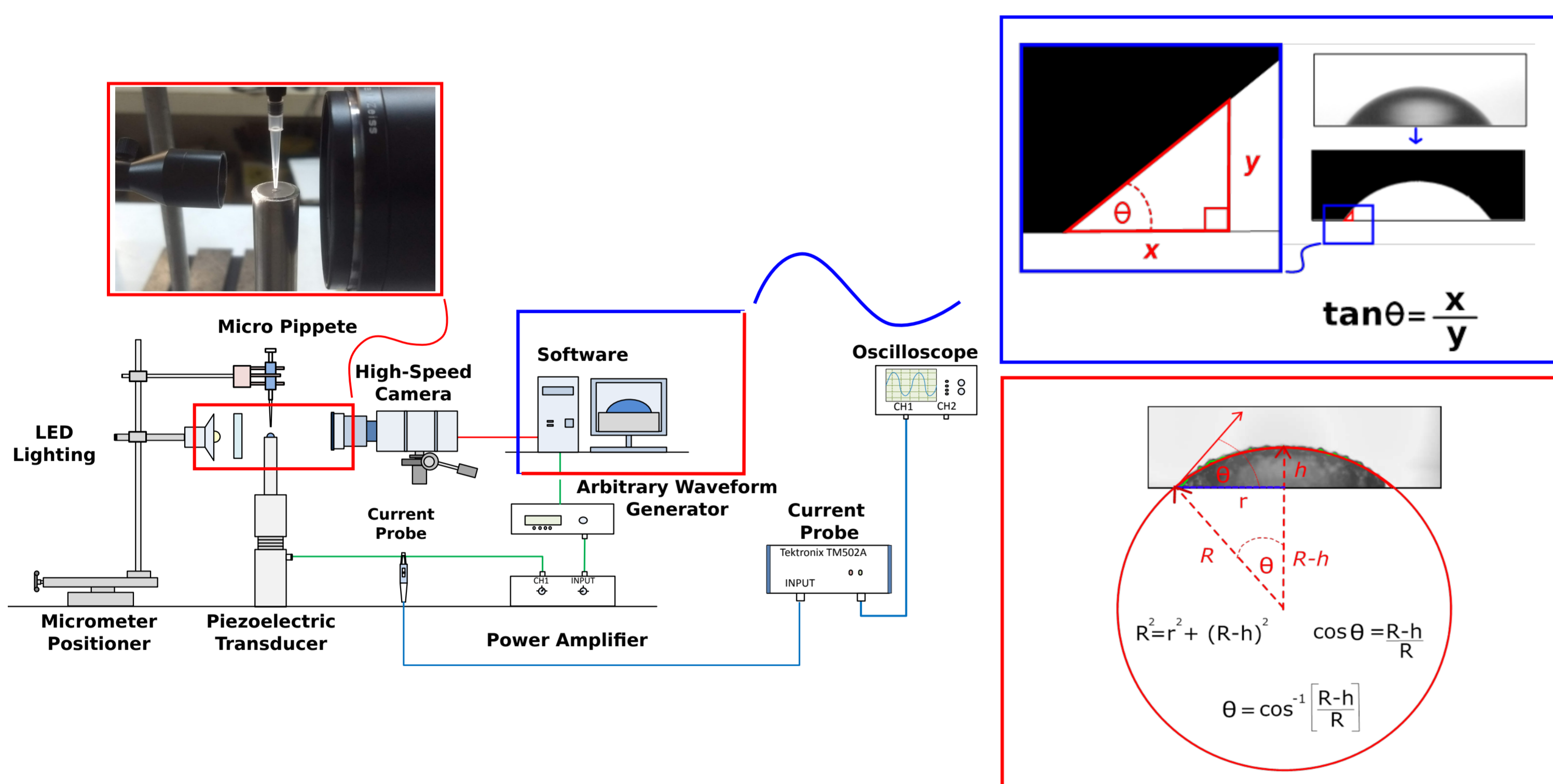


Figure 1. Left. Experiment setup. Right. Detection and calculation of contact radius, contact angle and height of a water droplet.

## RESULTS

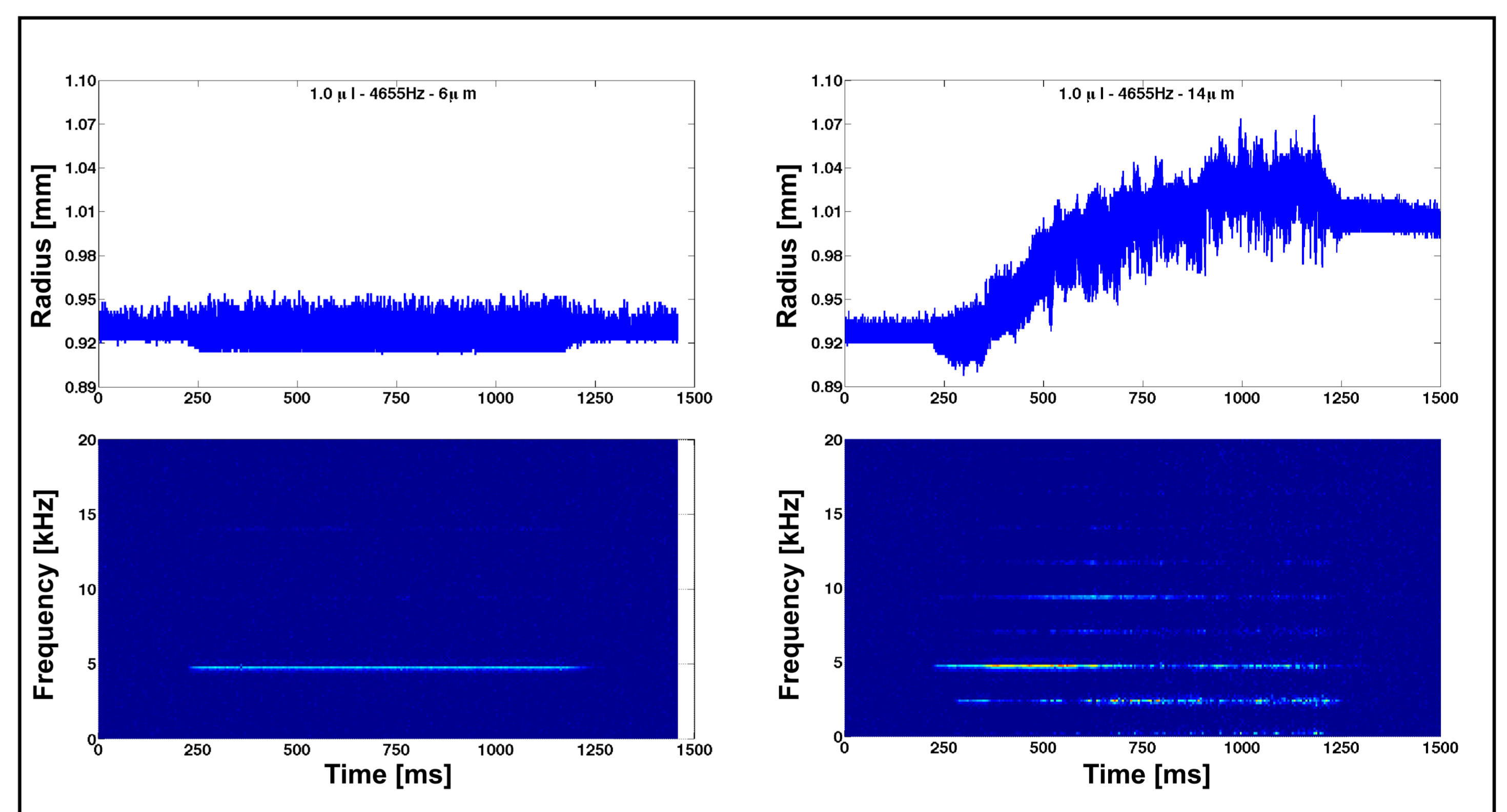


Figure 4. Time evolution of the contact radius and its frequency response of a water droplet of  $1.0 \mu\text{l}$  for two vibration amplitudes,  $6 \mu\text{m}$  (left) and  $14 \mu\text{m}$  (right) using a driving frequency at  $4655 \text{ Hz}$ .

## RESULTS

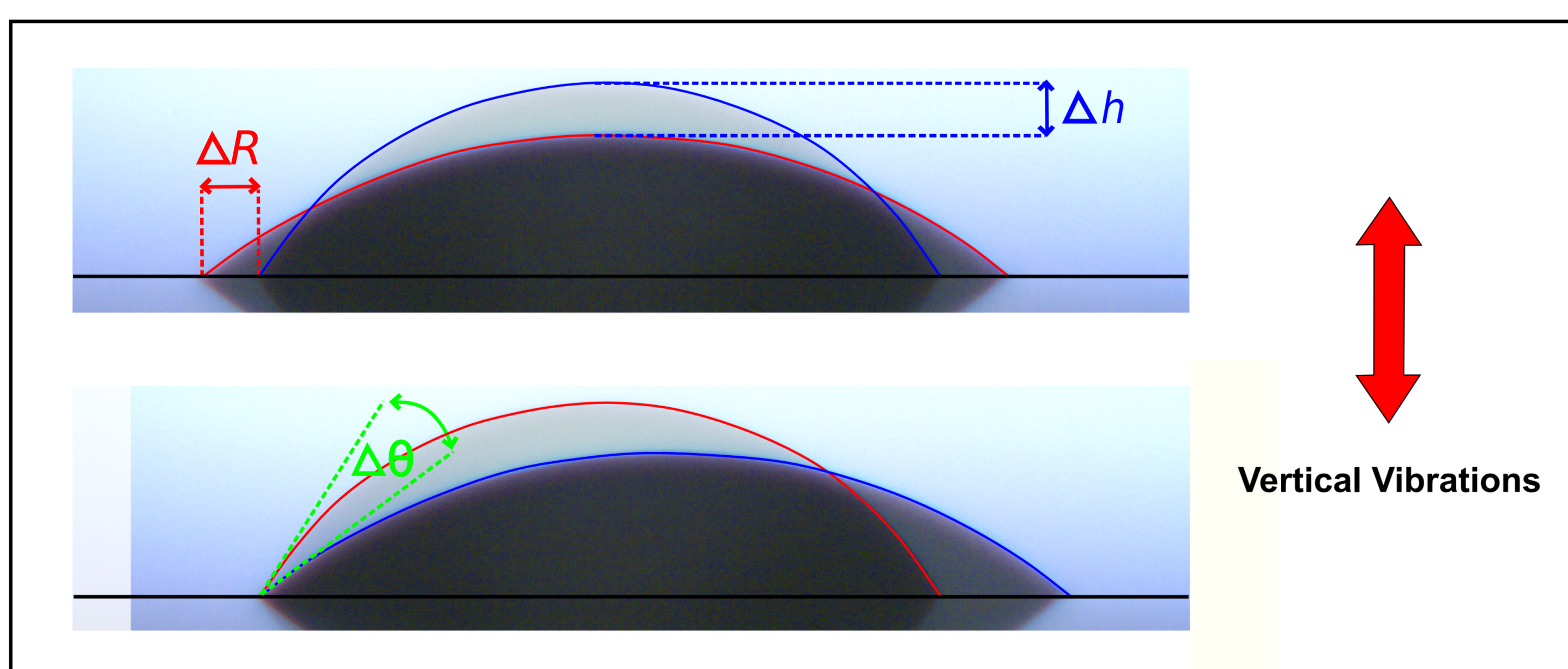


Figure 2. Schematic of the contact radius change, contact angle and height of a water drop before and after application of vertical vibrations.

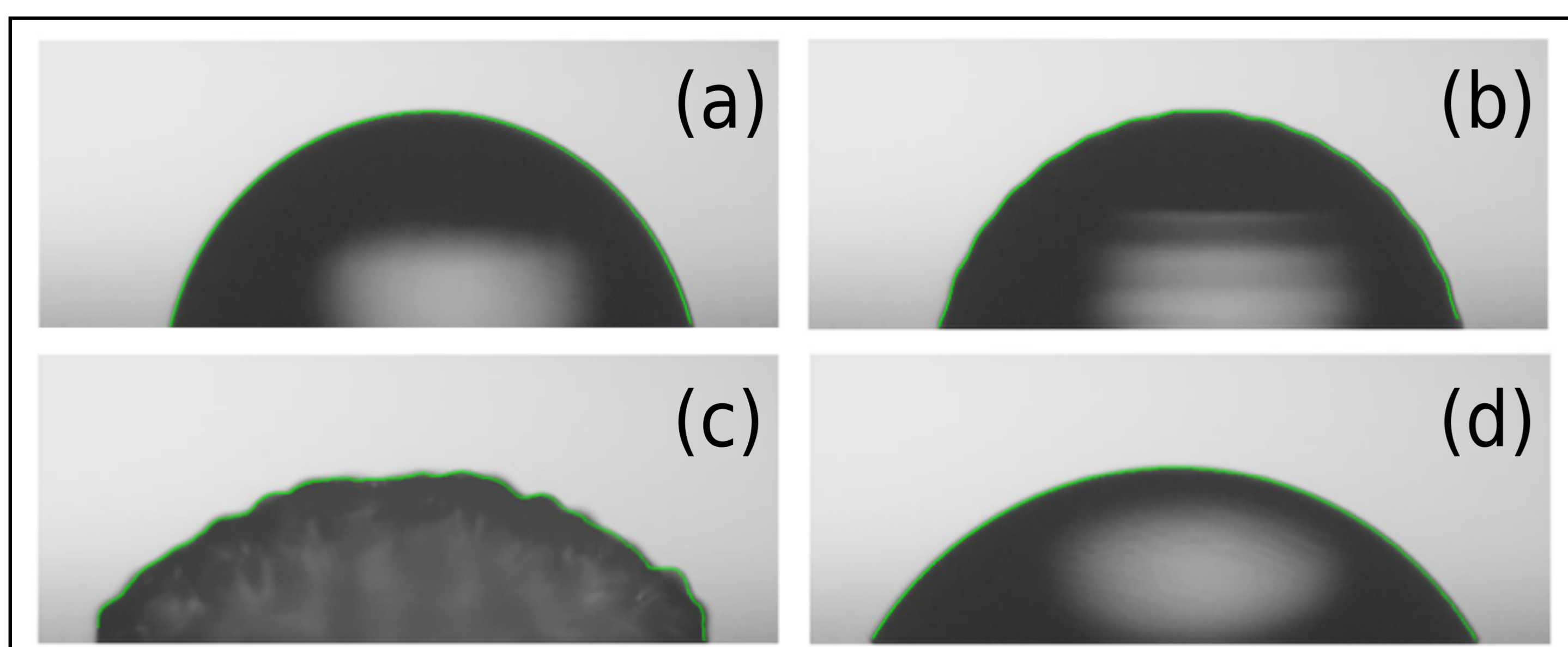


Figure 3. Image sequence of a water droplet spreads on a solid surface when vertical vibrations are applied. During this process, we can observe deformation at the surface of the liquid-vapor interface due to capillary waves (b) and (c). Also, the contact radius has increased, while the contact angle has decreased after application of vertical vibrations (d).

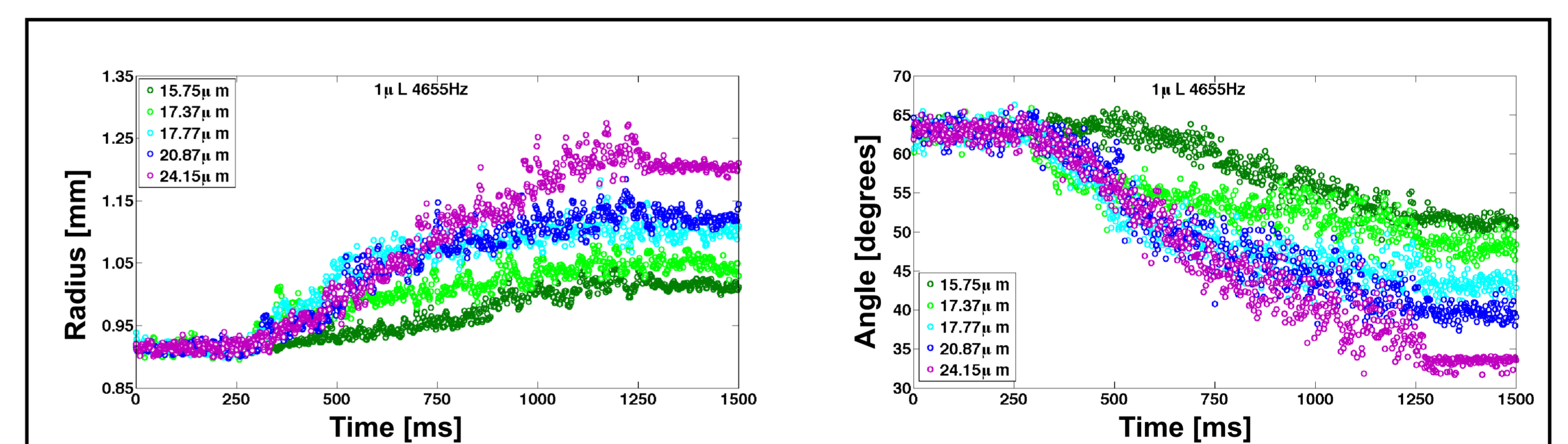


Figure 5. Left. Time evolution of the contact radius for a water droplet of  $1.0 \mu\text{l}$  for five different vibration amplitudes using a driving frequency at  $4655 \text{ Hz}$ . Right. Time evolution of the contact angle for the same vibration amplitudes used.

## CONCLUSION

We have detected an increase in the contact radius and a decrease in contact angle of a water droplet when vertical vibrations are being applied on a solid surface. We have determined that the solid surface wettability improves as increase as the vibration amplitude.

## ACKNOWLEDGMENT

Financial support by Universidad de Santiago de Chile and CONICYT - PFCHA / Doctorado Nacional / 2016 - 21160731