Spreading Dynamics of Water Film on a Vibrating Glass

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DISTINCTION THROUGH DISCOVERY

Figure 1.

Figure 2.

Figure 3.

Figure 4.

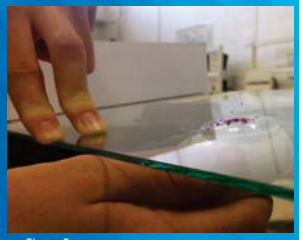

Figure 5.

HYPOTHESIS

The first hypothesis is that the movement of water can be influenced by the application of vibrations generated by ultrasonic sound.

The second hypothesis is that these vibrations can be used to expel water from the surface of the windshield of a car and serve as a potential alternative to traditional windshield wipers.

BACKGROUND

Today windshield wipers are used to improve visibility for drivers at times when weather is inclement. Although windshield wipers have been available for over 100 years they still operate using the same basic principle when they were developed in 1903 [1].

Through the use of vibrations produced by ultrasonic sound it is possible to excite water molecules in a way that causes them to levitate [2]. Therefore it is possible to create a device capable of producing sound vibrations that can keep a windshield free of rain in the midst of inclement weather. Using a device like this would have several benefits. For example it would provide increased visibility for the driver without the sweeping arcs created by the path of traditional wipers. In addition to this it would be far more economical and environmentally friendly because they would not have to be replaced and disposed of as often as traditional wipers.

SUPPORTING DATA

This research was conducted by using an ultrasonic massager to transmit vibrations through a piece of glass which had drops of water on top. Multiple angles of the glass were tested to see the reaction of the water drops when subjected to the vibrations generated by the massager. The angles tested were approximately zero degrees, eight degrees, and thirty-five degrees respectively (Figures 1-3). In Figure 4 we can see, that when the ultrasonic massager is applied to the glass at zero degrees, the vibrations excite the water drops enough so that they jump off the glass. It was also observed that if the massager was held in place for a long enough time the vibrations would cause the water drops to vaporize. For the eight degree and thirty-five degree angles we tested a section of the glass that was clean, and a section that had a water repellent treatment on the surface of the glass. Figure 5 shows the glass at eight degrees with several drops of water jumping due to the vibrations. Lastly, Figure 6 shows the results of the vibrations when the glass is at the thirty-five degree position and shows the difference between the treated and untreated glass. Notice how the water on the left (treated glass) left a streak and the water on the right (untreated glass) dribbled down the class without leaving a streak.

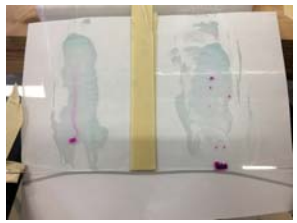

Figure 6.

CONCLUSION

In order for the vibration to influence the movement of water, the ultrasonic massager was applied in contact with the bottom of the glass while the drop of water was on top. The generated ultrasonic vibration caused the water molecule to bounce off the glass. If the vibration was applied for an extended period of time, the water droplet would start to vaporize. By observing of the effect of vibrations on drops of water, support is given to the possibility of a device that would use sound to expel water from a windshield.

REFERENCES

[1] https://www.uspto.gov/learning-and-resources/newsletter/inventors-eye/tracking-innovation-windshield-wipers

[2] http://math.mit.edu/~bush/wordpress/wp-content/uploads/2012/08/TibetanBowls.pdf