

Hydrophobic Water  
Fall 2020 IV 2 Report  
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Assisted by Hannah Moller



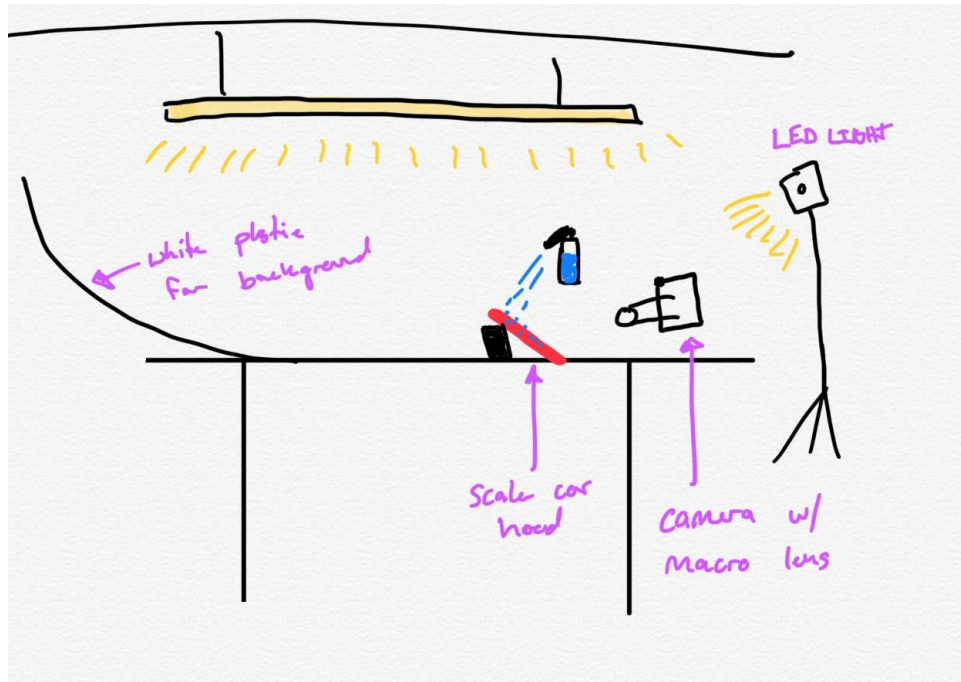
Video- <https://www.youtube.com/watch?v=ql2KnYcQDxI>

## Background

This report details the process, science and motivation behind the video link above. The video comparing a ceramic coating and car paint when exposed to water was created for video assignment three in MCEN 4151, flow visualization for mechanical engineers. The video is intended to show how water being sprayed reacts differently on different surfaces. Specifically, comparing car paint and car paint with a ceramic coating over it. A lot of science has gone into this field of research and the results of this experiment show some satisfying and beautiful video as well. It should be noted the company I work for specialized in the coating used in this experiment. Much of my research has come from our chemist and his experiments.

## Setup

In order to capture the video, the ceramic coating was applied to half of the hood (the tape line can be seen in the video), allowed to cure for a couple minutes, wiped clean. Then allowed to fully cure with no water for 24 hours. If the ceramic is introduced to water during the 24 hour cure it will begin to break down. After the coating cured I set up the hood at a 30 degree angle from the horizon, and positioned the camera about one foot away from the hood. Then Hannah Moller assisted in spraying water on the hood with a spray bottle while I captured the flow. Figure 1 below shows a sketch of the set up.



**Figure 1: Set up for recording the video.**

It can be noted I was able to shoot this video where I work and they have a table set up with an acrylic white background that curves up to make an 'infinity' wall. For initial

attempts this was nice since I was getting part of the background in the shot, but once I switched to the macro lens it was no longer needed.

### Science

The goal of this video was to capture a close up of how a superhydrophobic surface reacts to water versus a hydrophilic surface. The superhydrophobic surface being created by the ceramic coating and most define 'superhydrophobic' surfaces having a contact angle of more than 90 degrees. Below is a graphic to help the understanding of contact angle and surface tension of a droplet.

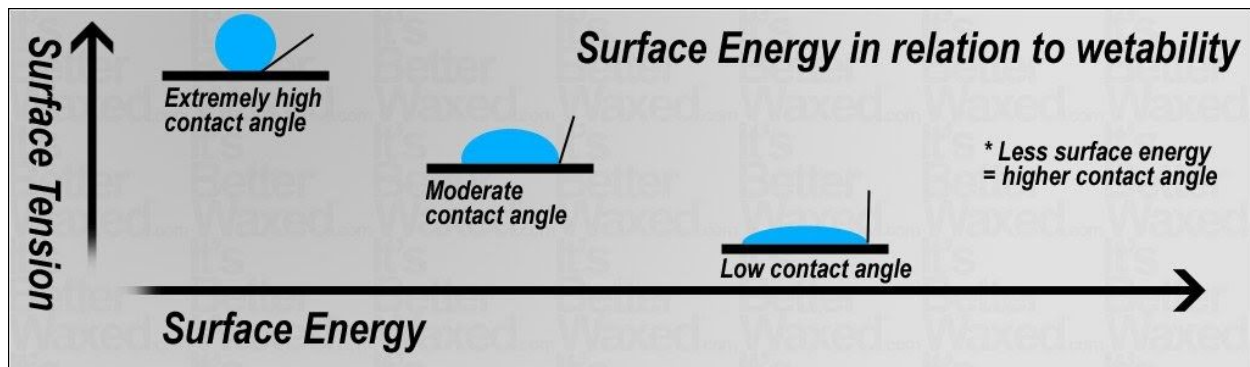


Figure 2: Contact angle reference.

Ceramic coatings cure to a hard shell. The hardness can be tested using ASTM C1624-05, the coating used resulted in a hardness of 9h, the highest score on the standard.

When looking at the video the left half of the surface was treated with a ceramic coating while the right side is clear coat, commonly found on modern vehicles to seal in the base coat paint. It can be observed that on the left side (with the coating) the water creates small beads with high contact angles. While on the right side, the water beads are larger and pool up together with low contact angles. Both sides show self cleaning as the water drops off of them. However the friction on the left side (with the coating) is much less.

### Videography

To capture this video I used a Canon Rebel T6 with a Canon 50mm macro lens. Shooting in video mode on manual focus. I set up a LED floor light behind, to the right, and above the camera, pointing at the subject of interest. I also used the rooms overhead LED lights to get more light into the lens and camera, and bounce the light off of the water droplets. As seen in Figure 1 the camera was not positioned perpendicular to the plate that was filmed. That resulted in the top and bottom of the video to be out of focus. For post processing I imported the video to my iPhone 12 and used iMovie.

Adding in a sound from the iMovie library, titles, and trimming the clip to the desired length. Then I uploaded the video at 1080p to youtube.

### **Conclusion**

This being our third image or video assignment and the first video I have done, I found it to be much more challenging. Specifically I felt this video was boring in a way, and lacked aspects of art and beauty. While the science behind it is very interesting to me and can get very complex between the chemistry and physics involved. While presenting the video to the class some good recommendations were made to make it a little more interesting. With the addition of a strong horizontal line between the ceramic and clear coat, or using colored water and lights. Overall I'm happy with the focus, and how the experiment showed up on camera. I think the macro lens helped bring out some details. I do think if I were to take a still of this experiment I would be able to capture more art and beauty. This was a fun way to explore video and in my opinion the results were not bad for my first try.

### **References**

Oglesbee, Colton, and Chris Gallahar. "The Science behind Ceramic Coatings." 9 Nov. 2020.

Posted by William Russell on January 29, 2. (n.d.). Do ceramic coatings prevent swirls? Retrieved November 10, 2020, from <https://itsbetterwaxed.com/blogs/detailing-tips/84593412-do-ceramic-coatings-prevent-swirls>