Dynamic Contact Angle Measurements of Superhydrophobicity in Face Masks To Minimize Exposure to COVID-19 (Year 3: Lab-to-Market)

Vaidyanathan, Annika (School: Winter Springs High School)

Superhydrophobicity, a high degree of water repellency, is characterized by a large contact angle between a liquid bead and a surface. Last year's project successfully treated masks with experimental hydrophobic coatings. Their ability to repel a COVID-19 sized particle suspension in synthetic mucus, emulating an infected breath (both in the velocity and concentration of particles), was tested using dynamic contact angle measurements. Last year due to the pandemic all measurements were done at home. This year, all those experiments were repeated in a laboratory goniometer to validate the measurements previously made at home for artificial saliva. In addition an atomizer was used this year to simulate the size and velocity of droplets from human breath. The durability of these masks was studied using an linear abrader, mimicking mask wear. Abrasion tests were followed by dynamic contact angle measurements taken with a goniometer to study the effect of wear, providing information on the durability of the coatings. The breathability of these masks was studied by measuring air flow through the coated masks. This was done to ensure that the coating did not disrupt the airflow of the wearer. A manufacturing procedure that coated a thread and wove the thread into masks was researched along with weave patterns that increased the hydrophobicity, again determined from dynamic contact angle measurements. Lastly, a cost and safety analysis of the finished product was performed. Overall, this year’s project reports research that, with the help of physics, takes the coated mask from the laboratory one step closer to the commercial marketplace.

Awards Won:

Second Award of $2,000