



CALIFORNIA STATE SCIENCE FAIR 2017 PROJECT SUMMARY

Name(s) Chunyi Zhou	Project Number J1824
Project Title Substrate-Liquid Wettability	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The science behind the phenomena of wettability is a fascinating one that finds its applications in many fields like adhesives, stain repellents, printing, and medical devices. Maximizing wettability is highly desired in many applications e.g. improving adhesion for adhesives or preventing nonspecific protein adsorption for implanted medical devices. The objective of this study is to understand what kind of liquid and solid substrates combination would yield the greatest wettability using the contact angle technique as a measure. Using the information obtained in this study, people working in applications that require optimal wettability can achieve their goals through adjusting the surface tension/surface energy.</p> <p>Methods/Materials Measurement software (ImageJ), Camera, Syringe with 0.1 ml increments, Stainless steel, Gold, Copper, Polyethylene terephthalate(PET), Teflon, Epoxy, Ceramic, Silicon, Glass slides, DI water, Cooking oil, Acetone, Isopropanol, 9% Polysorbate-20 (9% diluted). Record room temperature/humidity. Place dried substrate (rinsed by DI water and acetone) on the sample holder. Drop 0.05ml liquid from syringe onto substrate. Take the photo by camera. Analyze photo by software to get contact angle data.</p> <p>Results The average contact angle of DI water on stainless steel was 57.5 degrees, which suggested a low wettability. The same was true for 9% Polysorbate-20 on gold (contact angle of 46.3 degrees). At the same time, the combination of DI water on gold was approximately 70.8 degrees, suggesting a very low wettability; moreover, DI water on teflon demonstrated extremely low wettability (contact angle of 104.5 degrees). In contrast, a very high wettability was shown with isopropanol on all of the substrates: the contact angles were too low to measure on all the substrate except Teflon (21.7degrees).</p> <p>Conclusions/Discussion The combination of a high surface energy substrate and a low surface tension liquid yields maximum wettability. It is demonstrated by the results of isopropanol on all substrates except teflon and also by the results of cooking oil on silicon. All of them had extremely low contact angles, i.e. very high wettability. The opposite is to obtain minimum wettability: a low surface energy substrate and a high surface tension liquid are needed. For instance, DI water on teflon showed low wettability; in other words, the teflon is very hydrophobic.</p>	
Summary Statement How to maximize the wettability (measured by contact angle) of a solid surface	
Help Received I designed the experiments through internet search and text book reading. My science teacher helped to review my proposal. I performed the test and data analysis by myself. Dr. Xinpei Cao from Henkel Electronic Materials provided the substrates for experiments.	