Vortex Shedding from Superhydrophobic Cylinders

The research project consists of characterizing the flow past a cylinder coated with a superhydrophobic surface that is contained within a water tunnel seeded with reflective particles. The superhydrophobic surface is embedded with micro-features created via photolithography, aligned in the direction parallel to the flow, engineered to capture air between the features. The air-water interface allows for the fluid to slip past it without sticking to that surface. The amount of surface area in contact with the fluid is virtually reduced by about 50%, thus, resulting in a reduction in the amount of drag generated by the fluid flow over the surface of the cylinder.

Particle Image Velocimetry, PIV, is used to take a rapid succession of still images via a high speed camera and a laser beam which enable the capture of the path of the reflective particles along with their respective streamlines and the vortex shedding phenomenon observed within the wake region past the cylinder. PIV tests are performed within the water tunnel. Subsequently, these tests are analyzed using software that correlates the frequency at which the water tunnel is run and the velocity at which the reflective particles move along the cylinder. A video that is representative of the vortex activity is then generated, from which a relationship to the drag reduction can be determined.

The use of superhydrophobic surfaces is expected to affect the frequency, shape and separation point of vortices shed from the coated cylinder. An uncoated cylinder is included in the study to illustrate the new behavior associated with the partial slip surface.