Performance-enhancing... research? New measurement could help elite athletes

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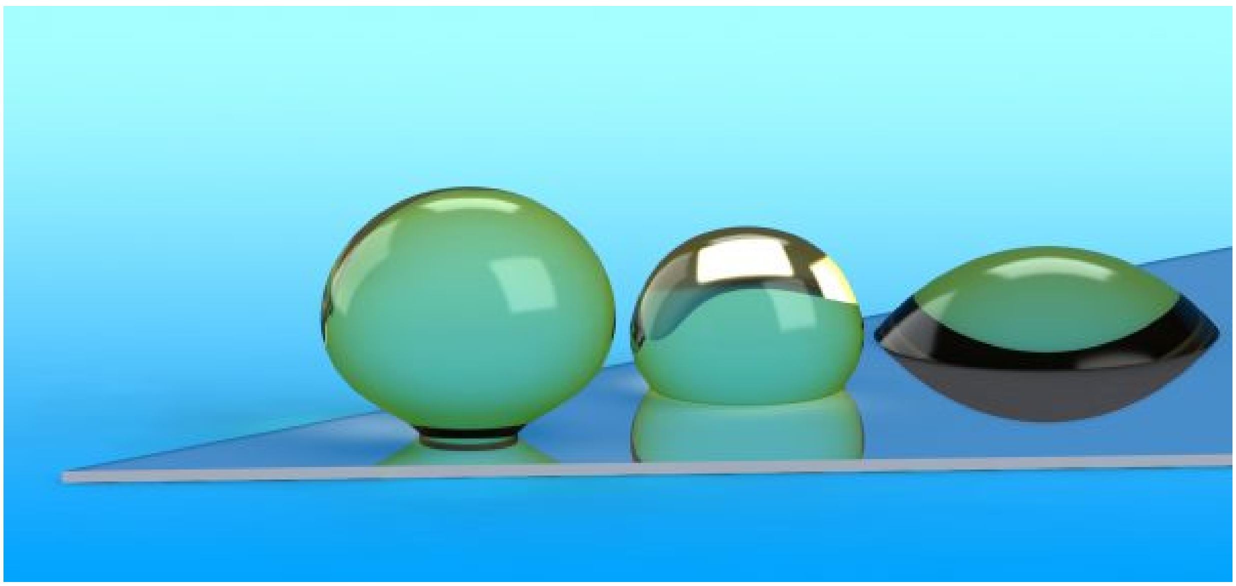

The three stages of drop spreading on any surface. Credit: York University

Canadian Olympic phenomenon Penny Oleksiak may be able to glide through the water even faster at her next Olympic Games, due in part to a new measurement tool invented by York University researchers.

"We asked ourselves the basic question: 'how does liquid spread on a surface?', be it Penny's swimsuit while underwater, or the morning dewdrops on grass," says Sushanta Mitra, a professor in York's Lassonde School of Engineering. "Oleksiak's exceptional ability in the pool is undeniable. A more advanced suit could help her beat her personal best by reducing fluid resistance underwater."

Mitra's research has resulted in a new technique that measures the rapid process of liquid drops spreading on any surface. Interface scientists in his Micro & Nano-scale Transport (MNT) lab at York U have created an experimentation tool with funding from the Natural Sciences and Engineering Research Council (NSERC). The tool, built with an optical path using specialized microscopic lenses, captures the bottom view and side view of a spreading drop. It enabled researchers to observe the initial stages of a drop spreading on any surface inside a glass container filled with water.

"Since water is a viscous medium, the spreading process was significantly slowed, which allowed us to discover the initial regime. This is the first time this process has ever been measured," says Mitra, whose team also performs breakthrough translation research in water quality monitoring. "Soon we'll have new and improved products in water-repellant coatings, materials with underwater drag reductions and the like, on the market," says Mitra.

Traditional drop spreading experiments are conducted in air and there needs to be a few nanometer resolution to accurately characterize the initial stage of the process. That is below the physical limit of current optical systems used in experiments, according to co-author Surjyasish Mitra, whose graduate studies at York focus on fluid dynamics. "We overcame the challenges of conducting experiments underwater by using the new tool which brought down the length scale to micron levels."

The study, "Understanding the Early Regime of Drop Spreading," is published as the cover feature in peer-reviewed journal for fundamental interface science *Langmuir*.

More information: Surjyasish Mitra et al. Understanding the Early Regime of Drop Spreading, *Langmuir* (2016). DOI: 10.1021/acs.langmuir.6b02189

Provided by York University