UIC engineer tests improved 'icephobic' coatings

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(PhysOrg.com) -- While scientists and engineers have developed several products that repel water and, to a lesser degree, snow and ice, considerable room remains for something "new and improved."

University of Illinois at Chicago mechanical and industrial engineering professor Constantine Megaridis hopes that he and his Micro/Nanoscale Fluid Transport Laboratory team at UIC will find new ways to meet this goal.

Megaridis received a $320,000 National Science Foundation grant to investigate what is called "icophobic behavior" by select surfaces. He uses coatings with tunable properties such as controlled micro-to-nanoscale texture that display the ability to repel water -- a property called superhydrophobicity -- or the ability to self-clean.

Megaridis's recent research to develop coatings that are both superhydrophobic and self-cleaning has yielded promising results. He now wants to begin research to see if such coatings can be improved, adding the "icephobic" quality and testing surface coatings that both shed water and conduct electricity.

"The main idea is to be able to provide a skin that's both phobic and electrically conducting -- the latter meaning you can heat it up," he said. "Imagine you have a chunk of ice anchored in a rough, cold surface. Trying to remove it is challenging because the ice is stuck. But if you add heat locally and melt the contact area between the ice and the

surface skin, you create a thin lubricating layer for the ice to slip off."

Megaridis's lab work will focus on characterizing various surface coatings to better understand how to make these surfaces improve water beading and roll-off. The shape of the water bead and inclination of a surface for water to roll off are two key properties characterizing surface phobicity, or surface energy -- which defines the affinity between a solid and liquid.

"Teflon, for example has very low surface energy. Water won't stick to it," Megaridis said. "Water sticks on metal preventing roll-off. Metals have high surface energy."

Megaridis and his laboratory team hope to learn how to make more durable, ice-repelling coatings for critical and high-value applications, such as energy-generating wind turbine blades.

"When ice deposits on turbine blades, it can rob a big portion of the turbine's output," he said. "Aircraft wing icing is another long-term problem we'd like to work on."

Megaridis says his laboratory has the right tools to study the problem. "We're trying to push science so that products get better in this area," he said. "We want to produce something that has value for the real world."

Part of the NSF grant will support science teachers at Chicago's Benito Juarez Community Academy, a high school in the city's Pilsen neighborhood near the UIC campus. Select students who hope to successfully compete in upcoming science fairs will be given the opportunity to work with UIC students in Megaridis's lab to learn more about scientific career opportunities and the discipline it takes to become a scientist.

"We hope to get these young students excited," he said. "We'll show them how research is being done. We'll also offer access to first-rate scientific research equipment."

Provided by University of Illinois at Chicago