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Creating a Coating of Water-repellant Microscopic Particles to Keep Ice off Airplanes

San Diego, Calif., Nov. 16 – To help planes fly safely through cold, wet, and icy conditions, a team of Japanese scientists has developed a new super water-repellent surface that can prevent ice from forming in these harsh atmospheric conditions. Unlike current inflight anti-icing techniques, the researchers envision applying this new anti-icing method to an entire aircraft like a coat of paint.

As airplanes fly through clouds of super-cooled water droplets, areas around the nose, the leading edges of the wings, and the engine cones experience low airflow, says Hirotaka Sakaue, a researcher in the fluid dynamics group at the Japan Aerospace Exploration Agency (JAXA). This enables water droplets to contact the aircraft and form an icy layer. If ice builds up on the wings it can change the way air flows over them, hindering control and potentially making the airplane stall. Other members of the research team are with the University of Tokyo, the Kanagawa Institute of Technology, and Chuo University.

Current anti-icing techniques include diverting hot air from the engines to the wings, preventing ice from forming in the first place, and inflatable membranes known as pneumatic boots, which crack ice off the leading edge of an aircraft's wings. The super-hydrophobic, or water repelling, coating being developed by Sakaue, Katsuaki Morita – a graduate student at the University of Tokyo – and their colleagues works differently, by preventing the water from sticking to the airplane's surface in the first place.

The researchers developed a coating containing microscopic particles of a Teflon-based material called polytetrafluoroethylene (PTFE), which reduces the energy needed to detach a drop of water from a surface. "If this energy is small, the droplet is easy to remove," says Sakaue. "In other words, it's repelled," he adds.

The PTFE microscale particles created a rough surface, and the rougher it is, on a microscopic scale, the less energy it takes to detach water from that surface. The researchers varied the size of the PTFE particles in their coatings, from 5 to 30 micrometers, in order to find the most water-repellant size. By measuring the contact angle – the angle between the coating and the drop of water – they could determine how well a surface repelled water.

The team will present their findings in a poster session at the American Physical Society's (APS) Division of Fluid Dynamics (DFD) meeting, which will take place Nov. 18 – 22, 2012, at the San Diego Convention Center in San Diego, Calif.

Presentation: "Effect of PTFE Particle on Super-Hydrophobic Coating for Anti-Icing" is at 5:50 p.m. on Sunday, Nov. 18 in Ballroom 20D Foyer.
Abstract: http://meeting.aps.org/Meeting/DFD12/Event/177678

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MORE MEETING INFORMATION
The 65th Annual Meeting of the American Physical Society (APS) Division of Fluid Dynamics will take place from November 18-20, 2012, in San Diego, Calif. It will bring together researchers from across the globe to address some of the most important questions in modern astronomy, engineering, alternative energy, biology, and medicine. All meeting information, including directions to the Convention Center, is at: http://apsdfd2012.ucsd.edu/

USEFUL LINKS
Main Meeting Web Site: http://apsdfd2012.ucsd.edu/
Searchable Abstracts: http://meeting.aps.org/Meeting/DFD12/APS_epitome
Directions and Maps: http://apsdfd2012.ucsd.edu/?page=Venue_and_Maps

PRESS REGISTRATION
Credentialed full-time journalists and professional freelance journalists working on assignment for major publications or media outlets are invited to attend the conference free of charge. If you are a reporter and would like to attend, please contact Charles Blue (dfdmedia@aps.org, 301-209-3091).

SUPPORT DESK FOR REPORTERS
A media-support desk will be available. Press announcements and other news will be available in the Virtual Press Room (see below).

VIRTUAL PRESS ROOM
The APS Division of Fluid Dynamics Virtual Press Room will be launched in mid-November and will feature news releases, graphics, videos, and other information to aid in covering the meeting on site and remotely. See: http://www.aps.org/units/dfd/pressroom/index.cfm

GALLERY OF FLUID MOTION
Every year, the APS Division of Fluid Dynamics hosts posters and videos that show evocative images and graphics from either computational or experimental studies of flow phenomena. The outstanding entries are selected for their artistic content, originality, and ability to convey information. They will be honored during the meeting, placed on display at the 2013 APS March Meeting, and appear in the annual Gallery of Fluid Motion article in the American Institute of Physics' journal, Physics of Fluids.

Selected entries from the Gallery of Fluid Motion will be hosted as part of the Fluid Dynamics Virtual Press Room. In mid-November, when the Virtual Press Room is launched, another announcement will be sent out.

This release was prepared by the American Institute of Physics (AIP) on behalf of the American Physical Society's (APS) Division of Fluid Dynamics (DFD).

ABOUT THE APS DIVISION OF FLUID DYNAMICS
The Division of Fluid Dynamics of the American Physical Society (APS) exists for the advancement and diffusion of knowledge of the physics of fluids with special emphasis on the dynamical theories of the liquid, plastic and gaseous states of matter under all conditions of temperature and pressure. See: http://www.aps.org/units/dfd/