Sharkskin for airplanes, ships and wind energy plants

May 19 2010

Yvonne Wilke, Dr. Volkmar Stenzel and Manfred Peschka engineered a paint system that can reduce the flow resistance of airplanes and ships. That saves fuel. (© Fraunhofer / Dirk Mahler)

(PhysOrg.com) -- To lower the fuel consumption of airplanes and ships, it is necessary to reduce their flow resistance, or drag. An innovative paint system makes this possible. This not only lowers costs, it also reduces CO2 emissions.

The inspiration - and model - for the paint's structure comes from nature: The scales of fast-swimming sharks have evolved in a manner that significantly diminishes drag, or their resistance to the flow of currents. The challenge was to apply this knowledge to a paint that could withstand the extreme demands of aviation. Temperature fluctuations of -55 to +70 degrees Celsius; intensive UV radiation and high speeds.

Yvonne Wilke, Dr. Volkmar Stenzel and Manfred Peschka of the Fraunhofer Institute for Manufacturing Engineering and Applied Materials Research IFAM in Bremen, Germany, developed not only a paint that reduces aerodynamic drag, but also the associated manufacturing technology. In recognition of their achievement, the team is awarded the 2010 Joseph von Fraunhofer Prize.

The paint involves of a sophisticated formulation. An integral part of the recipe: the nanoparticles, which ensure that the paint withstands UV radiation, temperature change and mechanical loads, on an enduring basis. "Paint offers more advantages," explains Dr. Volkmar Stenzel. "It is applied as the outermost coating on the plane, so that no other layer of material is required. It adds no additional weight, and even when the airplane is stripped - about every five years, the paint has to be completely removed and reapplied - no additional costs are incurred. In addition, it can be applied to complex three-dimensional surfaces without a problem." The next step was to clarify how the paint could be put to practical use on a production scale. "Our solution consisted of not applying the paint directly, but instead through a stencil," says Manfred Peschka. This gives the paint its sharkskin structure. The unique challenge was to apply the fluid paint evenly in a thin layer on the stencil, and at the same time ensure that it can again be detached from the base even after UV radiation, which is required for hardening.

When applied to every airplane every year throughout the world, the paint could save a volume of 4.48 million tons of fuel. This also applies to ships: The team was able to reduce wall friction by more than five percent in a test with a ship construction testing facility. Extrapolated over one year, that means a potential savings of 2,000 tons of fuel for a large container ship. With this application, the algae or muscles that attach to the hull of a ship only complicate things further. Researchers are working on two solutions for the problem. Yvonne Wilke explains: "One possibility exists in structuring the paint in such a way that fouling organisms cannot get a firm grasp and are simply washed away at high speeds, for example. The second option aims at integrating an anti-fouling element - which is incompatible for nature."

Irrespective of the fuel savings, there are even more interesting applications - for instance, with wind energy farms. Here as well, air resistance has a negative effect on the rotor blades. The new paint would improve the degree of efficiency of the systems - and thus the energy gain.

Provided by Fraunhofer-Gesellschaft

Citation: Sharkskin for airplanes, ships and wind energy plants (2010, May 19) retrieved 10 April 2024 from https://phys.org/news/2010-05-sharkskin-airplanes-ships-energy.html