What are superhydrophilic surfaces and their applications?

The term ‘superhydrophilicty’ implies extremely high wettability of a surface by water.
The contact angle is the parameter which quantitatively expresses the wettability of a surface by a fluid. The contact angles of less than 90 deg, typically 30~60 deg, indicate that the surface is wettable by the fluid. However, such contact between the fluid and the surface results into fluid droplets distributed over the surface. For the formation of a continuous thin film all over the surface, the contact angle has to very low, of the order of 5~15deg. The surfaces showing extremely low contact angles are called ‘superhydrophilic’ or ‘superlipophobic’.
The phenomenon of superhydrophilic surfaces has the following three aspects:

- The surface contains photocatalytic particles like titanium dioxide
- The surface is irradiated by light
- The surface is in nanostructured

The property of superhydrophilicity stems from the photocatalytic activity of the surface film containing TiO2 nanoparticles. Under the action of incident radiation, the surface assumes ionic character which greatly increases its surface energy. The affinity of the surface for water shows a sharp increase due to considerable lowering of the contact angle down to <10 degrees. Thus the water on the surface can no longer remain in the droplet form and spreads out evenly as a thin film. The nanostructure of the surface also aids this process due to a kind of ‘wicking effect’.
The formation of the thin film of water improves the transparency of the surface by making water invisible. This effect is made use of in developing antifog glass for uses such as automobile mirrors, head lamp covers and bathroom mirrors.
The other important application associated with superhydrophilicty is the self cleaning character of such surfaces. The spreading film of water gets under any dust and dirt particles present on the surface and sweeps them away. The hydroxyl radicals (OH*) and the super oxide anions (O2-) generated in the photocatalytic process decompose the dirt through redox reactions. This physico-chemical

effect provides self cleaning surfaces. This principle is used in developing self cleaning glass and coatings for the building exteriors.

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