Development of a glass surface structuring process for the collection of water vapor from seawater

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Freshwater scarcity is one of the world's biggest problems, affecting every continent and over 700 million people today [1]. With global warming, drought, overuse that do not respect sustainable development, this water shortage will become more widespread, while water is essential to life and is the most abundant resource on our planet, mainly in the form of salt water.

Tremendous efforts have been devoted to searching for practicable and efficient technological solutions for desalinating seawater and among them, solar-driven distillation processes, were found to be the simplest and the most environmentally sustainable. However, considerable progress remains to be made in terms of steam collection efficiency.

To this end, various hydrophobic to superhydrophobic structured glass surfaces, inspired by the shell of the Namib desert beetle [2], have been produced. Silica nanoparticles modified with different organotrichlorosilanes R-SiCl3 (octadecyl-, ethyl-, 1H, 1H, 2H-perfluorooctyl- trichlorosilane) have been successfully deposited on glass plate surfaces by means of a simple dip coating process [3]. These as-prepared surfaces have been characterized by SEM showing a quasi-homogeneous coating of the glass slides by the functionalized nanoparticles and by contact angle measurements (θ> 160 °) revealing their superhydrophobic character (figure 1).

These surfaces were subjected to seawater vapor condensation tests in our self-built desalination tank. Several studies have been carried out, such as the influence of the contact angle on the volume of water recovered, showing that the greater the contact angle, the greater the volume of water and the harvest was increased by 180% compared to untreated virgin glass. Moreover, the quality of the water was found to be close to demineralized water.

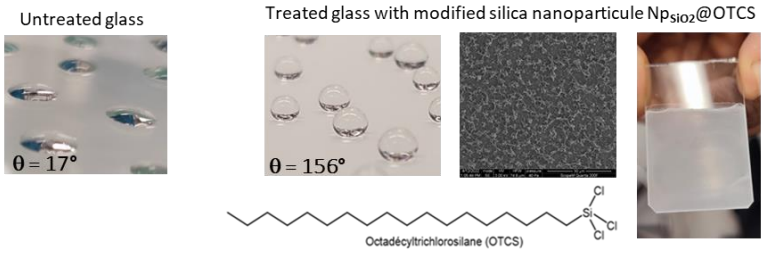

Figure 1: comparison between an untreated glass and a glass treated by dip coating with the compound OTCS

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