

ESTRUCTURAS TRIDIMENSIONALES SUPERHIDROFÓBICAS BIO-INSPIRADAS PARA EL DISEÑO DE PLATAFORMAS MULTIRREACCIÓN Y CAPTACIÓN DE AGUA DE NEBLINA

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Parahydrophobic surfaces (PHSs) composed of arrays of cubic μ -pillars with a double scale of roughness and variable wettability were systematically obtained in one step and a widely accessible stereolithographic Formlabs 3D printer. The wettability control was achieved by combining the geometrical parameters (H = height and P = pitch) and the surface modification with fluoroalkyl silane compounds. XPS and SEM-EDAX observed a homogeneous distribution of F and Si atoms onto the pillars. A nano-roughness on the heads of the pillars was achieved without any post-treatment. The smallest P values lead to surfaces with static contact angles (CAs) $>150^\circ$ regardless of the H utilized. Interestingly, the relationship $0.6 \leq H/P \leq 2.6$ obtained here was in good agreement with the H/P values reported for nano- and submicron pillars. Furthermore, experimental CAs, advancing and receding CAs, were consistent with the theoretical prediction from the Cassie–Baxter model. Structures covered with perfluorodecyltriethoxysilane with high H and short P lead to PHSs. Conversely, structures covered with perfluorodecyltrimethoxysilane exhibited a superhydrophobic behavior. Finally, several aqueous reactions, such as precipitation, coordination complex, and nanoparticle synthesis, were carried out by placing the reactive agents as microdroplets on the parahydrophobic pillars, demonstrating the potential application as chemical multi-reaction array platforms for a large variety of relevant fields in microdroplet manipulation, microfluidics systems, and health monitoring, among others.

On the other hand, under the current climatic conditions, one of the main problems has been the obtaining of vital natural resources for the survival of mankind; clearly, water is the most important of them. In several countries of the world, obtaining drinking water to satisfy the needs of all the inhabitants has been a challenge since the climatic changes that the world suffers due to the environmental ravages caused by the same human beings have polluted the water sources, or they have dried up. For this reason, science has been developing various methods to obtain water from different devices. However, what is often overlooked are the environmental conditions that arise, presenting opportunities for innovation and research into collecting water from climatic conditions such as fog and humidity. This research is focused on achieving a bioinspired 3D printing passive system for water harvesting from the air. This device was bio-inspired by the natural structures of some plants, which have taken advantage of these weather conditions to survive for years. But there are different factors that lead to water collection from these living organisms, such as the surface morphology, their roughness, shape, porosity, and others, as well as their corresponding physicochemical properties. We 3D-printed several cactus spines, taking as a basis its structural morphology and varying aspects such as the inclination of the tip, the roughness, and the spine contact area (solid or hollow). These designs promoted the best water uptake since a passive water collection system in the presence of fog.

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