

#PLATH00047

SURF / Plasma - surface interactions

Atmospheric pressure plasma microfluidic chips wettability treatment

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Abstract content

Microfluidics technologies are nowadays under the spotlight in many fields such as biomedical, pharmacology, and chemistry. These allow the manipulation of very small volumes of fluids thanks to miniaturized hydraulic systems obtained using advanced microfabrication techniques. Recently, geosciences have also jumped in the microfluidics revolution. Indeed, the ability of microfluidics to design well-controlled porous structures on chips and to isolate the overlapping hydro-bio-chemical phenomena occurring in the soils and the subsurface enables unprecedented visualization and characterization of the dynamic processes in geological porous materials. Despite all the recent progress, however, microfluidics for geosciences is still in its infancy. Geosciences microfluidic applications require hydrophilic sidewalls to mimic environmental subsurface behavior. These chips are basically made of polydimethylsiloxane (PDMS) that is natively hydrophobic and made hydrophilic during oxygen plasma activation/bonding. However, the wettability is not stable over time. In this work, we used an Atmospheric Pressure Plasma Jet (APPJ) for the treatment of the microchannels. This device is commonly used in plasma medicine and has the singular feature to generate a plasma that propagates away from the confinement of electrodes on several meters in a capillary tube. We explored the influence of a neon APPJ propagation along the microchannels in order to modify the wettability from hydrophobic to hydrophilic behavior. We succeeded to inject and propagate the plasma into PDMS-glass microchip (figure 1: Neon plasma propagating along a homemade PDMS on glass microfluidic chip). Depending on the treatment time, a significant change in the channel wettability was observed for blue-colored water circulation (figure 2: Flow front characterization at the inlet of the microchip a) before and b) after a plasma treatment - scale bar is 200μm).

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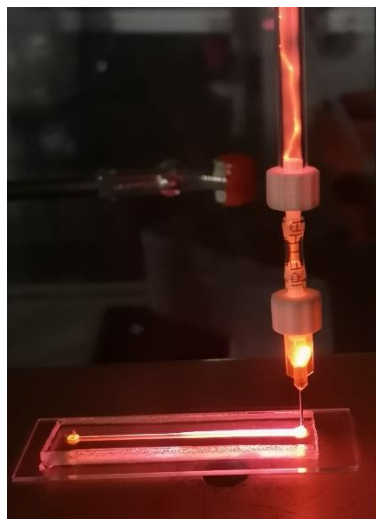


Figure 1

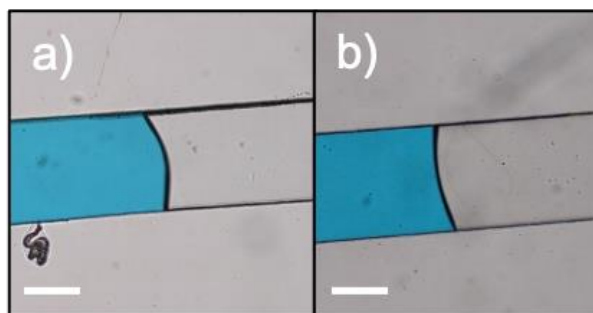


Figure 2