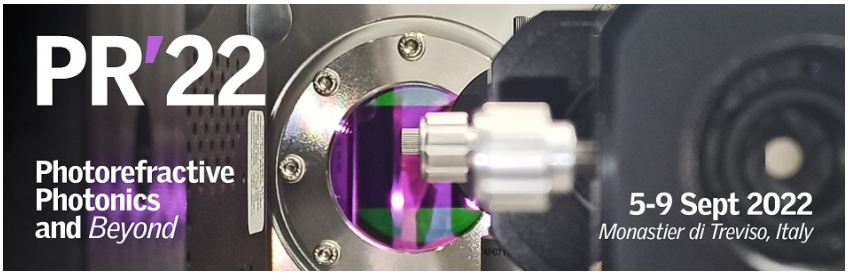

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Optofluidic platform for the manipulation of water droplets on engineered LiNbO3 surfaces

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The actuation of liquid droplets on a surface has important implications in many industrial applications and microfluidics. The reproducible motion of water droplets on solid surfaces is very difficult to achieve because of the presence of surface defects. Bioinspired liquid-infused surfaces (LISs), made of textured materials imbibed with a low surface tension oil, exhibit various unique properties attributed to their liquid-like nature. In particular, they enable low friction droplet motion.
In this work, droplet actuation is achieved by exploiting the photovoltaic effect of iron-doped lithium niobate (Fe:LiNbO3): when the crystal is illuminated, charges of opposite sign accumulate on the two faces of the crystal. This effect allows to create virtual and reconfigurable electrodes, that can be exploited to achieve droplet manipulation. The face of LiNbO3 in contact with the droplets is coated with the LIS to create a low friction surface. We have realized LISs impregnating a porous Teflon filter with a fluorinated oil using a dip-coater to ensure high reproducibility. This process allows one to obtain very slippery hydrophobic surfaces for prolonged use. Their performances are tested by analyzing the motion of repeated sequences of water droplets with different volumes and deposited on a sample tilted at different angles; it is found the LIS can be used safely for the motion of thousands of droplets. In this way, sessile water droplets having volumes of microliters, corresponding to millimeters in size, can be easily actuated, guided, merged and split by the projection on the crystal of suitable static or dynamic light patterns.

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