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Active optofluidic structures for analyte concentration and sensing

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Ordered arrays of metallic nanoholes have demonstrated great potential as sensors for the detection of analytes, including biomarkers for early diagnosis of diseases and viruses. These nanoplasmonic structures have been integrated into microfluidic environments in lab-on-chip formats towards the development of commercial-competitive biochemical diagnostics. The use of nanohole arrays in flow-through fashion has demonstrated additional benefits in terms of transport, such as targeted analyte delivery to the active sensing surface, effective analyte utilization and faster response times. In many applications, however, sensing must be achieved using samples with very low concentration of the target analyte. In order to overcome this challenge, concentration and purification stages are commonly employed before sensing. Among different approaches for achieving analyte preconcentration, electrokinetic techniques have demonstrated suitable for on-chip integration. The metallic nature of nanohole arrays offers the possibility to extend their use as active concentrators through electric field gradient focusing (EFGF) and the utilization of a pressure bias. Here we present the additional capabilities of the optofluidic structures to tailor the final concentration and spatial location of the analyte within the microfluidic chip, and the possibility to achieve transport control of the concentrated analyte using the nanoplasmonic structure as active switch. These demonstrated abilities extend the potentials of metallic nanohole arrays to achieve transport, concentration, active control and sensing using the same nanoplasmonic structure.

Biography

Carlos Escobedo is Assistant Professor at the Department of Chemical Engineering at Queen's University since May 2013. He received his Ph.D. from University of Victoria, Canada, and was an NSERC postdoctoral fellow with tenure at ETH Zürich, Switzerland. He has worked in the R&D biomedical sector and has lectured at four different universities in Canada and Mexico. He has published over 10 papers in reputed scientific journals and has already over 150 citations. His work has been featured in important scientific communications including Optics and Photonics News, Nanowerk and Nature Photonics.

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