Plasmonic Nanostructures Integrated in Microfluidic Chips for the Sensitive SERS Detection of miRNAs

Abstract

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Surface-enhanced Raman Scattering (SERS) is a leading technique for the development of innovative biosensors. Indeed, it can be used for the highly sensitive detection of biomolecules in complex biological samples, such as cell extracts or biofluids, taking advantage of plasmonic nanostructures. In this work, an overview of several SERS substrates based on different plasmonic nanostructures such as Ag-PDMS substrates, silvered porous silicon (pSi) on polydimethylsiloxane (PDMS) membranes, 3-D graphene-Ag based aerogels and flower-like Ag nanostructures is presented: each of these platforms have been used for biosensing applications. As a representative example, an elastomeric microfluidic multichamber chip, integrating porous silicon (pSi) membranes decorated with Ag nanoparticles, is here focused on the multiplex detection of miRNAs, short regulatory sequences involved in several diseases, including cancer. In order to exploit the SERS sensitivity, an innovative label-free protocol was developed. The effectiveness of the developed SERS sensing platform was demonstrated by detecting miR-222 into lung cancer cellular extracts, avoiding complex and expensive sample pre-treatments.