Label-free plasmon-enhanced Raman detection of biomarkers in neurodegenerative disorders

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Abstract

Plasmon-enhanced spectroscopies such as surface-enhanced Raman spectroscopy (SERS) and tip-enhanced Raman spectroscopy (TERS) concern the detection of enhanced optical responses of molecules in close proximity to plasmonic structures, which results in a strong increase in sensitivity. Recent advancements in nanofabrication methods have paved the way for a controlled design of tailor-made nanotools with fine-tuning of their optical and surface properties. The unique combination of sensitivity and selectivity of plasmon-enhanced spectroscopies coupled with the use of novel signal-enhancing plasmonic tools can offer a valuable choice for the effective chemical and structural sensing of species of biomedical interest.

We present several strategies recently implemented in our lab and based on the combination of plasmonic nanotools and plasmon-enhanced spectroscopies for label-free detection of biomarkers involved in neurodegenerative diseases. These include: 1) development of disposable supports comprising spot arrays of assembled plasmonic nanostructures for rapid and cost-effective analysis of sample drops; 2) ultradetection on the nanoscale of amyloid species and discrimination among toxic and non-toxic forms.

Overall, these supports offer potential for development of flexible and reliable sensing diagnostics of different molecular targets in the analytical and biomedical fields.