O-014

DNA 调控的金属纳米探针及其表面增强拉曼散射效应

宋世平*

中国科学院上海应用物理研究所，上海，201800

*Email: spsong@sinap.ac.cn

表面增强拉曼散射（SERS）效应以其在生物系统中的潜在应用受到人们越来越多的关注。目前，高SERS效应纳米探针的合成面临着信号强度不足，缺乏均一性，重复性差等一系列问题。我们利用DNA在纳米界面上的组装与调控技术合成了多种具有高SERS强度的金属纳米结构，这些纳米结构中均含有1-nm左右的纳米间隙。结果证明，SERS效应与纳米间隙的面积成正比关系。我们对纳米间隙的形成机制做了进一步研究，发现DNA的界面调控至关重要。通过优化合成条件，该纳米结构的SERS增强因子可达1.0×10^9，而且结构均一，重复性好。进而，我们将这一SERS纳米探针应用与生物分析系统。该探针在灵敏度、特异性、多元化等技术指标方面展示了强大的性能，具有非常广阔的应用前景。

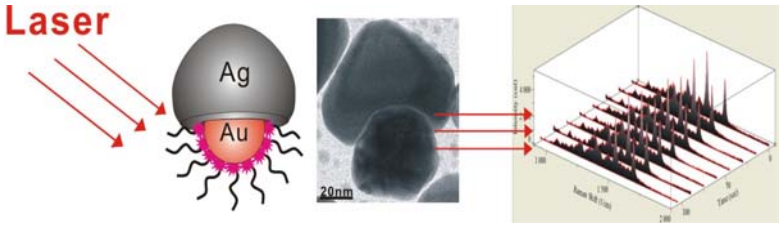

Fig. 1 A schematic illustrating the controllable synthesis of metal nanostructures and their SERS effect

关键词： 金属纳米结构；纳米间隙；表面增强拉曼散射效应；生物分析

DNA-mediated metal nanoprobes and their SERS effect

Shiping Song*

Shanghai Institute of Applied Physics, Chinese Academy of Sciences, Shanghai, 201800

Uniform metal nanostructures with well-defined nanogaps hold great promise for ultrasensitive surface-enhanced Raman scattering (SERS) analyses, nevertheless the direct synthesis of such nanostructures with strong and stable SERS signals remains highly chal-lenging. Here, we report a DNA-mediated approach for synthesizing metal nanostructures with interior nanogaps. The SERS intensities of these nanostructures were critically dependent on the area of the nanogap. We found that the elimination of sodium chloride was critical for the formation of the nanogaps. This effect is possibly the major barricade for synthesizing these SERS-active nanostructures. We also found that the formation of nanogaps were finely tunable by controlling the surface density of oligonucleotides on gold nanoparticles. Thus, we obtained highly SERS-active ($EF\approx1.0\times10^9$) metal nanostructures with 1 – 2 nm gaps in high yield. Importantly, these nanostructures worked well with bioanalytical systems and have potential to be universal probes for biosensing and cell imaging.