Light-induced Pin-Point Colloidal Assembly for Liquid-State SERS

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Surface-enhanced Raman scattering (SERS) is a representative plasmon-based detection method for sensitive molecular identification. However, conventional methods for fabricating SERS-active structures require complex and time-consuming steps such as lithography and metal deposition. Here, we demonstrate a simple detection method to obtain robust SERS signals for liquid samples. In this method, plasmonic nanoparticles and analytes are quickly assembled together at the light focused surface *via* convection flow induced by photothermal heating from the nanoparticles. By optimizing for the assemblies, intrinsic SERS signals of small molecules such as biomolecules and environmental pollutants are readily detected in various solvents. Moreover, we also observe large entities such as microplastics and microbes are co-assembled by following the convection flow, and successfully measure their distinct SERS signals. Finally, the SERS nanostructures co-assembled with analytes are verified via atomic force microscope. We expect that the proposed method can provide a powerful way to sensitively detect biologically and environmentally relevant analytes in liquid samples.