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SERS PACKAGING WITH MULTIPLE INLET AND OUTLET FEATURES

HP INC

SERS Packaging with Multiple Inlet and Outlet Features

Abstract: A 3D orifice plate for a SERS chip reduces or eliminates air bubble trapping in the chip.

This disclosure relates to the field of surface enhanced Raman spectroscopy (SERS).

A packaging technique is disclosed that provides multiple inlets and outlets for a SERS device.

SERS devices are often used in sensing applications in which liquid fills a chamber in the device. Current SERS devices use a 3D OP (orifice plate) having a single hole. This hole serves multiple functions: as an inlet for liquid filling, an outlet for liquid evaporation, and a window for letting in laser light and sensing. However, as liquid fills a chamber inside the SERS sensor for sensing, very often an air bubble can become trapped inside the chamber; because the geometry of the sensor is very small in size, the single hole is a poor outlet for air bubble release. An air bubble trapped in the chamber can cause multiple undesirable effects, such as insufficient chemical components entering into the sensor, a slowing of the evaporation process, and more.

According to the present disclosure, and as understood with reference to the Figure, a SERS device packaging technique uses a 3D OP (orifice plate) having multiple inlet and outlet features, instead of just a single hole.

A SERS device is illustrated in a cross-sectional view 10. The device comprises a substrate 20 and a 3D OP 30. A top view 15 illustrates the raised portion of the 3D OP 30. The device 10 has a chamber 40 which fills with liquid during a sensing application through a main hole 50 in the 3D OP 30. A plurality of pillars 45 are elevated from the substrate 20 into the chamber 40.

The 3D OP 30 also includes plural (in this example, four) auxiliary holes 60 which surround the main hole 50. The auxiliary holes 60 are smaller in dimension than the main hole 50.

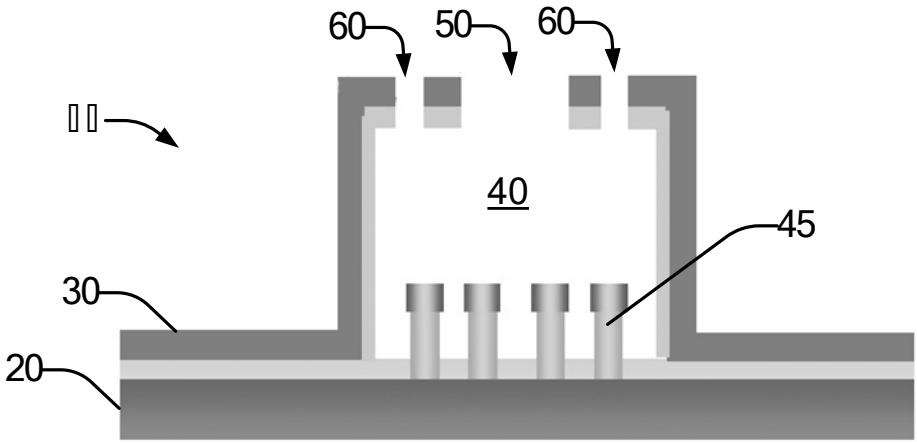
According to the disclosed technique, the main hole 50 serves as an inlet for liquid filling, as the main outlet for liquid evaporation, and as the window for laser light to enter the chamber 40 and for sensing. The auxiliary holes 60 serve as secondary outlets for liquid evaporation, and also for the release of air bubbles during liquid filling of the chamber 40. The auxiliary holes 60 minimize or eliminate air bubble trapping in the chamber 40.

The SERS device is typically of small size. In one example, the top dimension of the raised plane of the 3D OP 30 is 4 mm by 4 mm; the height of the 3D OP 30 is 20 to 50 um above the substrate 20; the height of the pillars 45 is 800 nm above the substrate 20. The diameter of the holes 50, 60 are typically in the range of 100 um to 1 mm.

The disclosed technique advantageously solves the air trapping problem without adding cost to the SERS device relative to a single hole 3D OP. By adding multiple inlet/outlet features, the main opening size can be reduced relative to the single hole design due to less demanding usage requirement, which in turn improves the mechanical strength of the

packaging. In addition, the small outlets provide faster evaporation time, which reduces the sensing waiting time.

Disclosed by Ning Ge, Anita Rogacs, Viktor Shkolnikov, and Helen A. Holder, HP Inc.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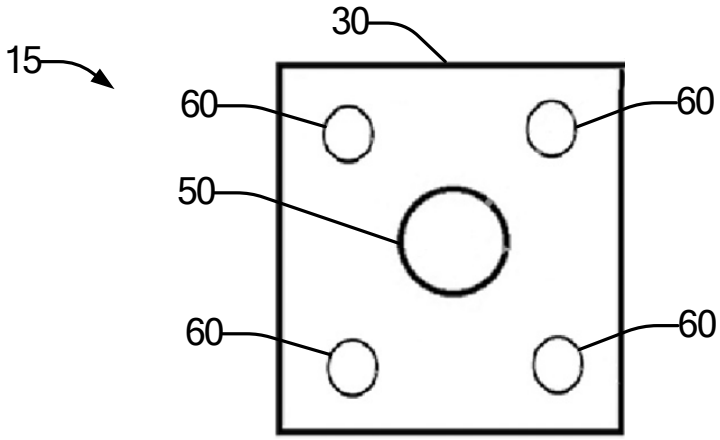
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