Fabrication of Silver Nanoparticle coated Silica Beads

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Method Article

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Abstract

This is a protocol to fabricate silver nanoparticle coated silica beads for optical trapping and surface enhanced Raman spectroscopy (SERS) measurement.

Introduction

Reagents

- Silver nitrate (≥ 99.0%, Sigma-Aldrich)

- Trisodium citrate (≥ 99.0%, Sigma-Aldrich)

- (3-aminopropyl) triethoxysilane (APTES) (≥ 98.0%, Sigma-Aldrich)

- Silica beads (5.0% w/v, Spherotech Inc.)

Equipment

Procedure

Silver nanoparticle (AgNP) Colloid Synthesis

1. 50 mL of 1 mM $AgNO_3$ aqueous solution is heated at 200 °C to boilling.

2. 1 mL of 0.1 M trisodium citrate solution is fast added into the solution.

3. The mixture is kept boiling for 16 min under constant stirring at 500 rpm, then allowed to cool down to room temperature.

4. The resultant colloidal mixture is of yellow-gray color. Excess reducing agent is removed by washing the AgNP colloid three times with Milli-Q ultrapure water.

APTES Modification of Silica Beads

5. 1 mL silica bead stock (5.0% w/v) is dried overnight at 60 °C and dispersed in 1 mL anhydrous ethanol.

6. 1 mL ethanol solution containing 0.2% APTES is mixed with above silica beads ethanol suspension and allowed to react for 24 h at room temperature under continuous stirring at 200 rpm.

7. After reacting for 24 h, the solution is purified by centrifuging three times at 1500 RCF for 10min using anhydrous ethanol and discarding the supernatant.

8. The remaining pellet is further dried slowly at 60 °C before dispersing in 4 mL distilled water.

Fabrication of AgNP coated Silica Beads

9. AgNP coated silica beads are prepared in 1 mL by continuous agitation of AgNP colloids and adding APTES modified silica beads in a volume ratio of 997:3. This process is performed at room temperature under agitation at 100 rpm.

Troubleshooting

Time Taken

Anticipated Results

Homogeneous AgNP coated silica beads are obtained with a desired packing density.