U.S. Corporate Headquarters
400 Valley Rd.
Warrington, PA 18976
1(800) 523-2575 / (215) 343-6484
1(800)343-3291 fax
info@polysciences.com

Polysciences Europe GmbH
Badener Str. 13
69493 Hirschberg an der Bergstrasse,
Germany
+(49) 06201-845200
+(49) 06201-8452020 fax
info@polysciences.de

Polysciences Asia-Pacific, Inc.
2F-1, 207 DunHua N. Rd.
Taipei, Taiwan 10595
(886) 2 8712 0600
(886) 2 8712 2677 fax
info@polysciences.tw

**TECHNICAL DATA SHEET 635**



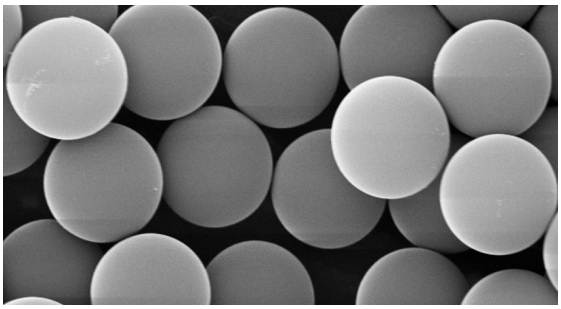
# Uniform Silica Microspheres

## DESCRIPTION

Polysciences offers uniform, non-porous silica ($SiO_2$) microspheres available in nominal diameters of ~150nm-8µm. These particles typically have size CVs of 10-15%.

Inorganic supports such as silica microspheres have become increasingly important for a variety of applications, including isolation of nucleic acids, cell separation, and immuno- and DNA-based assays. They offer the combined benefits of a broad platform and the unique properties of a silica substrate:

- Flexible silanization chemistries
- Unique refractive index and density
- Low autofluorescence
- Low nonspecific binding of many biomolecules
- Hydrophilicity
- Ease of handling



*Scanning Electron Microscope image of our (4.14µm) silica microspheres.*

## CHARACTERISTICS

| | |
|---|---|
| **Composition:** | SiO2, nonporous |
| **Surface Groups:** | SiOH (non-functionalized); $NH_2$ or COOH; streptavidin |
| **Refractive Index:** | ~1.43-1.46 (589nm) |
| **Density:** | 2.0 g/cm$^3$ |
| **Glass Transition Temp:** | >>1000˚C (Reported value for bulk silica.) |

## NOTES

1. **Aggregation:** If observed, aggregation may be treated using sonication (bath sonicator, ~10 minutes; probe sonicator, ~1 minute).
2. **Washing:** Standard washing methodologies are recommended, i.e. centrifugation where practicable, and dialysis or filtration for microspheres <500nm. Please note that carboxyl (COOH) or amine ($NH_2$) surface groups (from silane) will equilibrate with those in the suspending solution. It is therefore expected that some amount of surface groups will be removed with each aqueous wash.
3. **Transitioning Microspheres into a Solvent and Drying:** Silica microspheres >0.5µm in diameter may be dried to a powder. To dehydrate the surface (removed adsorbed water), the microspheres should first be washed with an organic solvent, such as ethanol or THF. Researchers should then begin by transitioning the microspheres from an aqueous buffer to solutions of increasing solvent concentration, and then separating them from solution (via settling, centrifugation, or filtration). The microspheres are then dried from a moist cake, either in the open air or in a drying oven (e.g. 24 hours at 70˚C). The dry cake may be crushed to a powder with a mortar and pestle. Dried powder will be extremely hygroscopic, and may be stored in a sealed desiccator with desiccant changed as needed, if required for the application.
4. **Suspending Dry Microspheres:** Dry silica microspheres may be dispersed in aqueous buffers or solvents (e.g. ethanol, methanol, THF, or DMSO). An appropriate amount of silica powder should be added to the fluid of interest (dilute suspensions are easier to handle), typically around 1 – 10%), and rigorously vortexed. The vial or tube containing the silica suspension should then be placed in a sonic bath. *(Note: Probe sonicators are typically ineffective for dispersing powders.)* Bath sonicate for ~10 minutes, and confirm that the microspheres are dispersed by viewing a drop of suspension under a light microscope (400X magnification). Individual microspheres 1µm or larger may be discerned at this magnification, and clumps of smaller microspheres will be clearly visible. If clumps are visible, continue to bath sonicate for 10 minute cycles until the spheres are fully dispersed. For continued issues with aggregates/clumps, pre-grinding of the powder with a mortar/pestle may aid in resuspension. Furthermore, a filter of appropriate pore size can be used to remove undesired aggregates (surfactant may be necessary during the filter process to prevent the formation of a cake over the pores). It's also important to remember that pH, salts, or the buffer, could be contributing to clumping as well.
5. **Coating Microspheres:** To covalently couple biomolecules to silica microspheres, the spheres must first be derivatized. This typically involves the regeneration of hydroxyl groups through an acid incubation (2N nitric acid at room temperature for 1 hour with rotation) followed by immediate silanization, or drying and later silanization. Acid-washed or derivatized (silanized) spheres should be stored dry with a desiccant. See the References section for additional protocols.

Adsorption is a common strategy for the assembly of lipid bilayers and for the isolation of nucleic acids. Silica microspheres may be coated with proteins via adsorption however, as desorption of protein from the hydrophilic bead surface is expected to occur over time, covalent coupling

is a better coating strategy for applications that require long-term stability. See the Storage and Stability section below.

## REFERENCES

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## STORAGE AND STABILITY

As a general note on stability of functionalized silica, the surface is stabilized in aqueous systems by coating proteins or other large molecules that are likely to have multi-point attachment. Surface groups will be lost if the uncoated $NH_2$- or COOH-silica beads are stored as an aqueous suspension, or if small molecules (that have only single point attachment, e.g. peptides, oligos, or small molecule dyes) are coupled and stored in aqueous buffers. These are typically stored in a solvent, e.g. acetone, ethanol, etc. Acid-washed or functionalized silica may be stored dry at room temperature or in solvent (e.g. EtOH) to preserve surface groups.

Store suspended (plain and coated) silica particles at 2-8˚C. Freezing may result in irreversible aggregation and loss of binding activity.
Coated silica microspheres should be stored in a buffer or suspending solution that is suitable for both the biomolecule and the silica matrix. Stability of coated microspheres should be determined empirically.
Dry particles should be stored tightly sealed at room temperature. A desiccator with desiccant may be employed if needed.

**This product is for research use only and is not intended for use in humans or for *in vitro* diagnostic use.**

## ORDERING INFORMATION

| Cat. # | Description | Nom. Diam. | % Solids | Size |
|---|---|---|---|---|
| 24298 | Silica Microspheres (broad distribution, colloidal) | 0.01µm | 5 | 10ml |
| 24040 | Silica Microspheres, colloidal | 0.05µm | 5 | 10ml |
| 24041 | Silica Microspheres, colloidal | 0.10µm | 5 | 10ml |
| 24320 | Silica Microspheres | 0.15µm | 10 | 15ml |
| 24321 | Silica Microspheres | 0.30µm | 10 | 15ml |
| 24322 | Silica Microspheres | 0.40µm | 10 | 15ml |
| 24323 | Silica Microspheres | 0.50µm | 10 | 15ml |
| 24324 | Silica Microspheres | 0.70µm | 10 | 15ml |
| 24325 | Silica Microspheres | 0.90µm | 10 | 15ml |
| 24326 | Silica Microspheres | 1.0µm | 10 | 15ml |
| 24327 | Silica Microspheres | 1.5µm | 10 | 15ml |
| 24328 | Silica Microspheres | 2.0µm | 10 | 15ml |
| 24329 | Silica Microspheres | 2.5µm | 10 | 15ml |
| 24330 | Silica Microspheres | 3.0µm | 10 | 15ml |
| 24331 | Silica Microspheres | 4.0µm | 10 | 15ml |
| 24332 | Silica Microspheres | 5.0µm | 10 | 15ml |
| 25341 | Silica Microspheres – Dry | 0.3µm | 100 | 1.5g |
| 25342 | Silica Microspheres – Dry | 0.5µm | 100 | 1.5g |
| 25343 | Silica Microspheres – Dry | 1.0µm | 100 | 1.5g |
| 25344 | Silica Microspheres – Dry | 1.5µm | 100 | 1.5g |
| 25345 | Silica Microspheres – Dry | 2.5µm | 100 | 1.5g |
| 25346 | Silica Microspheres – Dry | 3.0µm | 100 | 1.5g |
| 25347 | Silica Microspheres – Dry | 4.0µm | 100 | 1.5g |
| 25348 | Silica Microspheres – Dry | 5.0µm | 100 | 1.5g |
| 25349 | Silica Microspheres – Dry | 6.0µm | 100 | 1.5g |
| 24756 | Silica Amine | 0.5µm | 100 | 1g |
| 24757 | Silica Amine | 1.0µm | 100 | 1g |
| 24758 | Silica Amine | 5.0µm | 100 | 1g |
| 24753 | Silica Carboxyl | 0.5µm | 100 | 1g |
| 24754 | Silica Carboxyl | 1.0µm | 100 | 1g |
| 24755 | Silica Carboxyl | 5.0µm | 100 | 1g |
| 24759 | Silica Streptavidin | 0.5µm | 1 | 2ml |
| 24760 | Silica Streptavidin | 1.0µm | 1 | 2ml |
| 24761 | Silica Streptavidin | 5.0µm | 1 | 2ml |

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