

## TECHNICAL DATA SHEET 635

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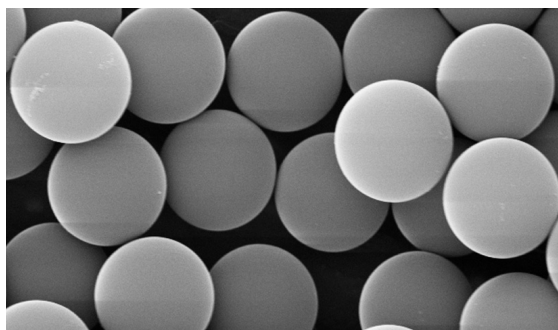
# Uniform Silica Microspheres

### DESCRIPTION

Polysciences, Inc. offers uniform, non-porous silica ( $\text{SiO}_2$ ) microspheres available in nominal diameters of  $\sim 150\text{nm}$ - $5\mu\text{m}$ . 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 ( $4.14\mu\text{m}$ ) silica microspheres.

### CHARACTERISTICS

Composition:	$\text{SiO}_2$ , nonporous
Surface Groups:	$\text{SiOH}$ (non-functionalized); $\text{NH}_2$ or $\text{COOH}$ ; streptavidin
Refractive Index:	$\sim 1.43$ - $1.46$ ( $589\text{nm}$ )
Density:	$2.0\text{ g/cm}^3$
Glass Transition Temp:	$\gg 1000^\circ\text{C}^*$

\* Reported value for bulk silica.

### NOTES

1. **Aggregation:** If observed, aggregation may be treated using sonication (bath sonicator,  $\sim 10$  minutes; probe sonicator,  $\sim 1$  minute).

2. **Washing:** Standard washing methodologies are recommended, i.e. centrifugation where practicable, and dialysis or filtration for microspheres  $< 500\text{nm}$ . Please note that carboxyl ( $\text{COOH}$ ) or amine ( $\text{NH}_2$ ) surface groups are in equilibrium with those in the suspending solution. It is therefore expected that some amount of surface groups will be removed with each wash.
3. **Transitioning Microspheres into a Solvent and Drying:** Silica microspheres  $> 0.5\mu\text{m}$  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  $70^\circ\text{C}$ ). The dry cake may be crushed to a powder with a mortar and pestle.
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), 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  $\sim 10$  minutes, and confirm that the microspheres are dispersed by viewing a drop of suspension under a light microscope ( $400\times$  magnification). Individual microspheres  $1\mu\text{m}$  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.
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 ( $2\text{N}$  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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- Weetall, H.H.** 1993. Preparation of immobilized proteins covalently coupled through silane coupling agents to inorganic supports. *Applied Biochem Biotechnol*, 41(3):157-188.

**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<sub>2</sub>- 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 4°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.

**These products are for research use only and are 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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