Product Data Sheet 702

Silica Microspheres

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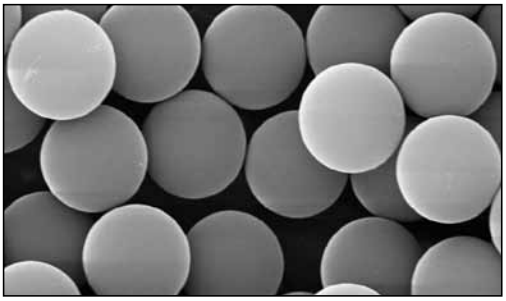
Bangs Laboratories, Inc.

B E A D S ● A B O V E T H E R E S T ™

DESCRIPTION

Bangs Laboratories offers uniform, non-porous silica (SiO2) microspheres available in nominal diameters of ~150nm-8µm. These particles typically have size CVs of 10-15%.



Scanning Electron Microscope image of Bangs Laboratories' (4.14µm) silica microspheres.

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

CHARACTERISTICS

Composition:	SiO_2, nonporous
Surface Groups:	SiOH (non-functionalized); NH_2 or COOH; streptavidin
Refractive Index:	~1.43-1.46 (589nm)
Density:	2.0 g/cm3
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). See also TechNote 202, *Microsphere Aggregation*.
2. *Washing*: Standard washing methodologies are recommended, i.e. centrifugation where practicable, and dialysis or filtration for microspheres <500nm. See TechNote 203, *Washing Microspheres*. Please note that carboxyl (COOH) or amine (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 >0.5µm 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.
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 ~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.
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 (see TechNote 204, *Adsorption to Microspheres*); 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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3. **Iler, R.K.** 1979. *The chemistry of silica: solubility, polymerization, colloid and surface properties, and biochemistry.* New York: John Wiley & Sons.

4. **Kumar, A., O. Larsson, D. Parodi, Z. Liang.** 2000. Silanized nucleic acids: a general platform for DNA immobilization. *Nucleic Acids Res*, 28(14):e71.
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6. **Walsh, M.K., X. Wang, B.C. Weimer.** 2001. Optimizing the immobilization of single-stranded DNA onto glass beads. *J Biochem Biophys Methods*, 47(3):221-231.
7. **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_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.

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

ORDERING INFORMATION

Cat. Code	Description	Diam. Range	Sizes
SS02N	Silica Plain	≤0.49µm	0.5g, 1.5g, or 5.0g
SS03N	Silica Plain	0.50-0.99µm	0.5g, 1.5g, or 5.0g
SS04N	Silica Plain	1.00-1.99µm	0.5g, 1.5g, or 5.0g
SS05N	Silica Plain	2.00-4.99µm	0.5g, 1.5g, or 5.0g
SS06N	Silica Plain	≥5.00µm	0.5g, 1.5g, or 5.0g
SC02N	Silica Carboxyl	≤0.49µm	0.5g, 1.5g, or 5.0g
SC03N	Silica Carboxyl	0.50-0.99µm	0.5g, 1.5g, or 5.0g
SC04N	Silica Carboxyl	1.00-2.49µm	0.5g, 1.5g, or 5.0g
SC05N	Silica Carboxyl	2.50-5.00µm	0.5g, 1.5g, or 5.0g
SA02N	Silica Amine	≤0.49µm	0.5g, 1.5g, or 5.0g
SA03N	Silica Amine	0.50-0.99µm	0.5g, 1.5g, or 5.0g
SA04N	Silica Amine	1.00-2.49µm	0.5g, 1.5g, or 5.0g
SA05N	Silica Amine	2.50-5.00µm	0.5g, 1.5g, or 5.0g

Cat. Code	Description	Nom. Diam.	Sizes
CS01N	Silica Streptavidin	0.5µm	1mL, 2mL, 5mL, or 10mL
CS01N	Silica Streptavidin	1.0µm	1mL, 2mL, 5mL, or 10mL
CS01N	Silica Streptavidin	5.0µm	1mL, 2mL, 5mL, or 10mL

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