EVONIK INDUSTRIES

Catalyst Carrier

Newsletter

Issue 02 / 2010

Designing Porous Particles

1 Specialty Silica Fundamentals

SIPERNAT® Specialty Silica are produced by acidification of an aqueous alkali silicate solution. The primary particles, which are initially generated, subsequently form aggregates and agglomerates. This leads to sponge-like structures and particle sizes typically in the micrometer range. Figure 1 illustrates schematically the structure of Specialty Silica and Figure 2 features a micrograph of a typical SIPERNAT® Specialty Silica surface, showing the sponge-like agglomerate structure with numerous pores of different sizes.

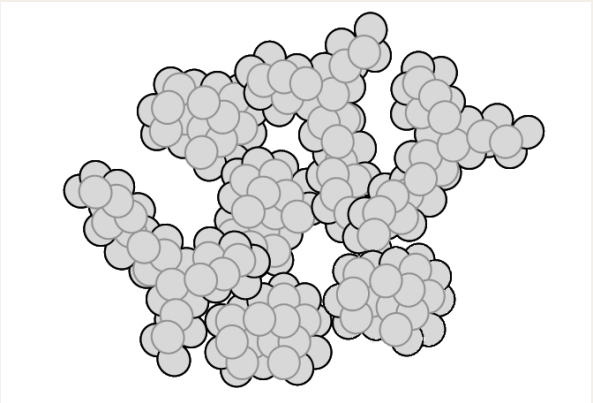


Figure 1
Structure of Specialty Silica

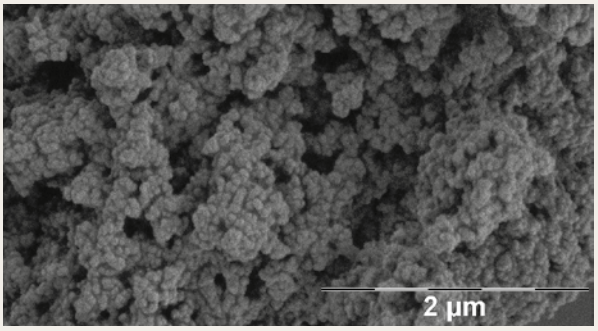


Figure 2
SEM Image of Surface and Pore Structure of Specialty Silica

2 Designing Porosity

For silica-supported catalyst applications, the specific surface area of the silica is highly important. We have addressed the need for high surface area silica types with our products SIPERNAT® 50 and SIPERNAT® 310. They show a specific surface area of 500 m^2/g and 700 m^2/g respectively; however, these grades are best characterized as classical Specialty Silica and thus show a broad pore size distribution with part of the surface area to be found in the micropore range. Under further processing (such as extrusion and calcination) of these silica grades a significant fraction of the micropores, and hence surface area, will be lost. To address this at times limiting phenomenon, Evonik has specifically designed a class of mesoporous Specialty Silica types.

Three examples of these mesoporous silica grades are EXP 4210-1, 4215-1 and 4230-1. They combine a well-defined pore size distribution, which is usually found in silica gels, with the good processability of Specialty Silica during granulation or extrusion. Figure 3 shows the pore size distribution of these three experimental silica grades.

Figure 3
Pore size distribution (N_2 desorption) of mesoporous EXP grades

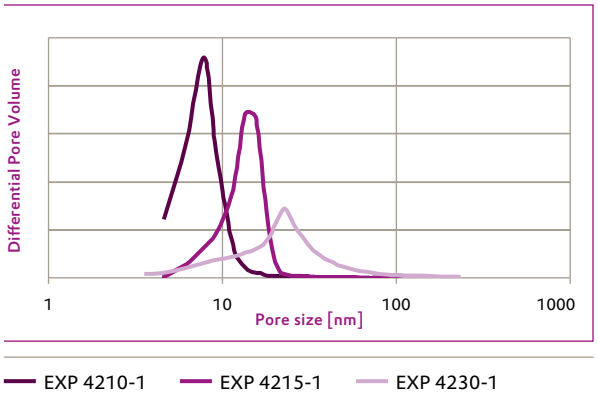
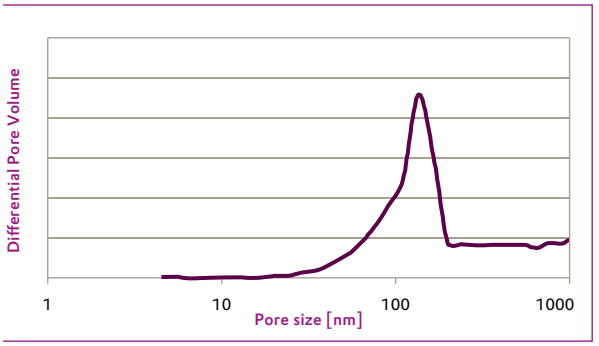


Figure 4
Pore size distribution (Hg intrusion) of SIPERNAT® 350



Another unique type of Specialty Silica is SIPERNAT® 350. This macroporous grade is ideally suited whenever large molecules such as biocatalysts need to be fixed on a silica support. Figure 4 shows the pore size distribution of this grade (measured by Hg intrusion).

3 Product Overview

A selection of recommended grades and their typical properties is given below. These data should be seen only as an example; further variation, according to the customers need, is possible.
Contact us. Challenge us.

4 Conclusion – SIPERNAT® Specialty Silica

Because Evonik can design the pore structure of SIPERNAT® Specialty Silica by carefully controlling the reaction conditions, a wide portfolio of products is available to meet our customers' needs. Look to the SIPERNAT® trade name for a broad range of Specialty Silica grades with different particle morphologies, surface areas and well adjusted pore size distributions.

Table 1
Properties of selected silica types. The values given are typical data and not part of the specification.

Silica Grade	Specific surface area (N_2) TriStar Multipoint following ISO 9277 [m^2/g]	Particle Size, d50 Laser diffraction following ISO 13320-1 [µm]	Description
EXP 4210-1	560	< 20	EXP 4210-1 is a mesoporous silica with high surface area and an average pore size in the 10 nm range.
EXP 4215-1	350	< 30	EXP 4215-1 is a mesoporous silica with medium surface area and an average pore size in the 15 nm range.
EXP 4230-1	290	< 10	EXP 4230-1 is a mesoporous silica with medium surface area and an average pore size in the 20 nm range.
SIPERNAT® 50	500	50	SIPERNAT® 50 is a high surface area silica with a wide pore size distribution.
SIPERNAT® 310	700	8.5	SIPERNAT® 310 is a high surface area silica with a wide pore size distribution.
SIPERNAT® 350	55	4.5	SIPERNAT® 350 is a macroporous silica with low surface area and an average pore size in the 150 nm range.

North America

Evonik Degussa Corporation
Inorganic Materials
379 Interpace Parkway
P.O. Box 377
Parsippany, NJ 07054-0677
USA

PHONE +1 888 745-4227
FAX +1 732 981-5310
catalyst-carrier-nafta@evonik.com

Asia / Pacific

Evonik Degussa (SEA) Pte. Ltd.
Inorganic Materials
3 International Business Park
#07–18 Nordic European Centre
Singapore 609927

PHONE +65 6 890-6031
FAX +65 6 890-6872
catalyst-carrier-asia@evonik.com

EVONIK INDUSTRIES

Europe / Middle-East / Africa / Latin America

Evonik Degussa GmbH
Inorganic Materials
Rodenbacher Chausse 4
63457 Hanau-Wolfgang
Germany

PHONE +49 6181 59-4858
FAX +49 6181 59-4096
catalyst-carrier-eu@evonik.com

www.evonik.com

Evonik. Power to create.