

FUMED METAL OXIDES



CABOT

creating what matters

**CAB-O-SIL[®] TG-C Series
treated colloidal silicas for toners**





CAB-O-SIL®TG-C Series treated colloidal silicas for toner applications

The CAB-O-SIL TG-C Series of treated silicas was developed to meet the performance challenges presented by smaller toner particles, faster printing speeds, and lower Tg (glass transition temperature) polymers. For toner particles, the TG-C Series treated silicas provide:

- Excellent anti-blocking and spacing
- Better durability of toner particles
- Excellent free flow
- Improved toner transfer efficiency
- Tribocharge stability

The TG-C Series of treated silicas is based on colloidal silicas that are available in a range of particle sizes and surface treatments allowing the toner formulator to find the optimum performance.

Product properties

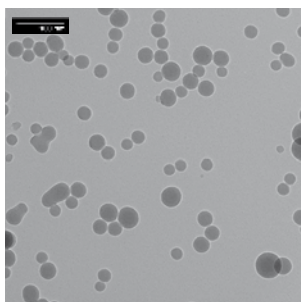
■ Morphology

The Transmission Electron Micrographs in Figure 1 highlight the differences in shape between a TG-C colloidal silica, a fumed silica of similar surface area, and an aggregated TG-C colloidal silica. The TG-C Series products are individual, spherical particles unlike fumed silica which is highly aggregated.

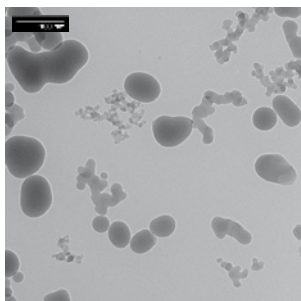
The colloidal silicas used as the basis for the TG-C Series products range in particle size from 50 to 200 nm as measured by Dynamic Light Scattering. The TG-C Series products have larger particle size and narrower particle size distribution than fumed silicas.

Large particles are recommended for spacing and improved durability and transfer efficiency. Smaller particles are recommended for excellent free flow and charging.

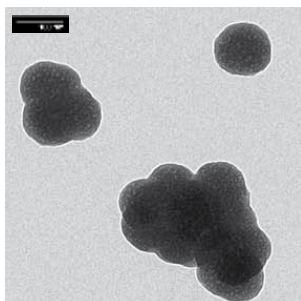
Figure 1.



TG-C treated silica



Large particle size fumed silica



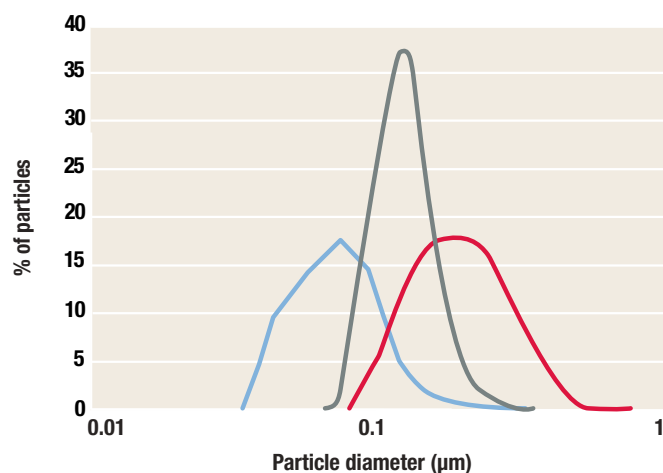
TG-C aggregated colloidal silica

Figure 2 shows the particle size distributions of the colloidal silicas used for the TG-C Series product range. The TG-C6020N grade is based on the largest particle size aggregated colloidal silica. TG-C413 is based on the smallest particle size colloidal silica. These particle properties yield optimum spacing between toner particles to prevent blocking (toner particles sticking together). As a result toners incorporating a TG-C product exhibit better durability and free flow.



Figure 2.

Particle size and distribution¹ of CAB-O-SIL TG-C Series treated silicas



Surface chemistry

The surface of all the TG-C silicas is fully treated. Surface treatment increases hydrophobicity, reducing moisture adsorption, even at high relative humidity. Figure 3 compares the moisture adsorbed by an untreated, colloidal silica and a TG-C grade with a fully treated surface. The hydrophobicity of the TG-C Series provides more consistent toner performance in challenging environmental conditions.

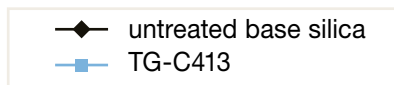
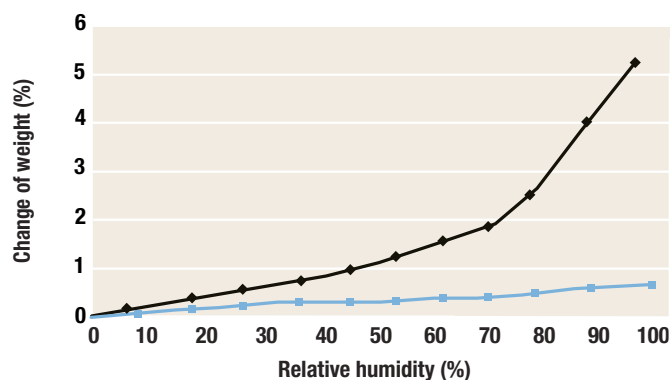


Figure 3.

Moisture adsorption by silicas



Product performance

In general larger particles provide better spacing or anti-blocking. Larger particles have less tendency to imbed into the toner particle. The TG-C Series is available in a range of particle sizes to allow the formulator to balance performance for each toner formulation. Free flow is not solely a function of particle size. Particle surface treatment and toner polymer also influence free flow performance. The charging behavior of the TG-C Series is controlled by the surface treatment. Commercially available materials are all negatively charging. If you are interested in positively charging colloidal additives, please contact us.

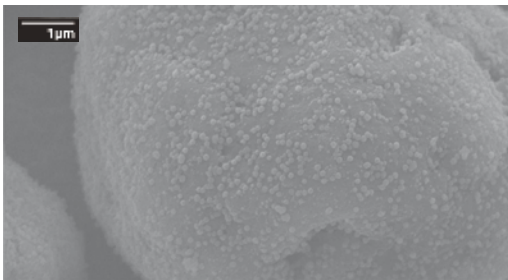
| | TG-C 6020N | TG-C 190 | TG-C 413 |
|----------------------------|------------------|-----------|---------------|
| PRODUCT PROPERTIES | | | |
| Particle Size, nm* | 200 (aggregated) | 115 | 50 |
| Treatment(s) | HMDZ | OTES | HMDZ |
| PRODUCT PERFORMANCE | | | |
| Tribocharge | Negative | Negative | Very Negative |
| Free Flow | Good | Fair | Excellent |
| Spacing | Excellent | Excellent | Fair |
| Durability | Excellent | Excellent | Good |
| Transfer | Excellent | Excellent | Good |

* Particle size of the colloidal silica before treatment was measured by Dynamic Light Scattering methodology."

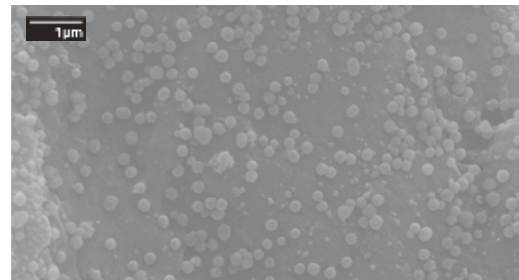
Figure 4 contains SEMs of a toner particle coated with a TG-C product. The image on the bottom at magnification of 20,000X clearly shows the individual, spherical silica particles, evenly distributed on the surface of the toner particle. The TG-C Series are non-agglomerating and easily dispersed to individual, spherical particles with minimal dispersion energy.

CAB-O-SIL TG-C grades have considerably higher bulk density than fumed silica allowing for easier handling and incorporation into toner formulations. Depending on the TG-C grade product density ranges from 250 to 350 g/l as measured by tapped density. As with fumed silica the specific gravity of the TG-C grades is 2.2 g/l.

Figure 4.
Scanning electron micrographs of a TG-C Series product on a toner particle



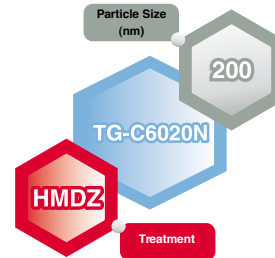
10,000X



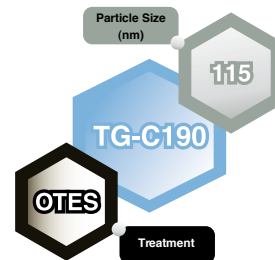
20,000X

CAB-O-SIL TG-C Series products

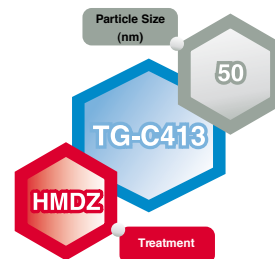
TG-C6020N CAB-O-SIL TG-C6020N is the largest aggregated colloidal silica additive modified with hexamethyldisilazane (HMDZ). The particle size provides excellent spacing and anti-blocking and improved transferability for toners. The surface treatment gives a negative tribocharge making TG-C6020N a good choice for negative charging toners.



TG-C190 CAB-O-SIL TG-C190 is the largest particle size treated spherical silica modified with octyltriethoxysilane (OTES). The large particle size provides excellent spacing and anti-blocking for toners. The surface treatment gives a slightly negative tribocharge making TGC190 suitable for use in both negative and positive charging toners.



CAB-O-SIL TG-C413 is the smallest particle size treated colloidal silica modified with hexamethyldisilazane (HMDZ). The particle size provides adequate anti-blocking and durability for toners. The surface treatment gives a negative tribocharge making TG-413 the best choice for negative charging toners.



■ Additional TG-C Series Products

New TG-C products are continuously being developed to meet the challenges presented to the toner formulator by new technologies and increasing performance requirements. A wide range of particle sizes and treatments are available to create products to meet precise performance requirements. TG-C products can be tailored to meet your specific needs. For further information contact your regional sales or technical service representative.

Cabot in the world

With business extending in 19 countries, Cabot has 6 fumed metal oxides manufacturing facilities in the world, besides research and development facilities focused in developing new products and technology and bringing new solutions to our customers.



Technical centers:

- Billerica, MA - USA
- Rheinfelden - Germany
- Shanghai - China

Addresses

North America

Cabot Corporation
Business and Technical Center
157 Concord Road
Billerica, MA 01821-7001
USA
Tel: +1 978 663 3455
Tel: 800 462 2313 (*Technical Service*)
Fax: +1 978 670 7035
Tel: 800 526 7591 (*Customer Service*)

Europe

Cabot
Interleuvenlaan, 15 i
B - 3001 Leuven
BELGIUM
Tel: +32 16 39 24 00
Fax: +32 16 39 24 44

South America

Rua do Paraíso, 148 - 5th floor
Paraíso CEP 04103-000 São Paulo SP
BRASIL
Tel: +55 11 2144 6400
Fax: +55 11 3253 0051
Tel: 0800 195959 (*Customer Service*)

Middle East/Africa

Cabot Specialty Chem. Inc.
Jebel Ali Free Zone
LOB 15, Office 424 - PO Box 17894
Dubai
UNITED ARAB EMIRATES
Tel: +971 4 8871 800
Fax: +971 4 8871 801

China

Cabot (China) Limited
558 Shuangbai Lu
Wujing Shanghai,
201108 CHINA
Tel: +86 21 5175 8800
Fax: +86 21 6434 5532

Japan

Cabot Specialty Chemicals Inc.
Sumitomo Shiba-Daimon Bldg. 11F
2-5-5 Shiba Daimon, Minato-ku
Tokyo 105-0012, JAPAN
Tel: +81 3 6820 0255
Fax: +81 3 5425 4500

Notice and Disclaimer. The data and conclusions contained herein are based on work believed to be reliable; however, Cabot cannot and does not guarantee that similar results and/or conclusions will be obtained by others. This information is provided as a convenience and for informational purposes only. No guarantee or warranty as to this information, or any product to which it relates, is given or implied. CABOT DISCLAIMS ALL WARRANTIES EXPRESS OR IMPLIED, INCLUDING MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE AS TO (i) SUCH INFORMATION, (ii) ANY PRODUCT OR (iii) INTELLECTUAL PROPERTY INFRINGEMENT. In no event is Cabot responsible for, and Cabot does not accept and hereby disclaims liability for, any damages whatsoever in connection with the use of or reliance on this information or any product to which it relates.

© Cabot Corporation, MA-U.S.A. All rights reserved 2010.

www.cabot-corp.com/fmo

CAB-O-SIL® is a registered trademark of Cabot Corporation



CABOT

creating what matters