

WACKER

CREATING TOMORROW'S SOLUTIONS

POWER ER

WITH HDK®.



HDK® FOR TONERS

THE POWER IN POWDER –
HDK® IN POWDER TONERS





PURE SILICA, PURE PRINTING PERFORMANCE

Expertise, Experience and a
Feeling for Customer Requirements

With over 50 years of experience in the production of HDK® silica products, WACKER has spent more than 40 years on the development of HDK® grades for electrophotographic applications. Our integrated production system, statistical process control and highly efficient reactor dynamics combine to make an exceptionally pure silica with high performance.

Unique WACKER production processes yield HDK® as highly branched aggregates, forming weakly bound agglomerates. By post-treatment of these basic building blocks with siloxanes and silanes we are able to offer highly hydrophobic HDK® grades.

The outstanding properties of HDK® unfold in powder toners. Optional process steps such as structure modification, grinding and classification enable tailored products to meet our customer's expectations. WACKER thereby contributes to features such as toner flowability, chargeability and stability of powder toners in electrophotographic processes.

HDK® is a registered trademark of Wacker Chemie AG.

HDK® BRINGS HIGHEST PRECISION TO LIGHT

HDK® for toners can be evenly dispersed into powder toners during the additive blending step. HDK® as external additive reduces interactions between toner particles causing enhanced toner free flow. The silicas may act as spacer making the toner endure mechanical stress that appears during printing processes. HDK® products influence the toner's charge profile through tribo-

chargeability. Being highly hydrophobic the HDK® helps to exclude moisture and thereby allows to control the toner's environmental stability.

The addition of the appropriate HDK® product to a toner contributes to a high image quality and printing efficiency and may support OPC cleaning.

HDK® – the Effective Additive for Powder Toners

- Easy dispersion in the additive blending step
- Improvement of toner flowability
- Optimization of the toner's charge profile
- Adjustment of the toner's stability vs. stress
- Control of the toner's humidity sensitivity



HDK® BY WACKER – UNIQUE PROPERTIES FOR OPTIMUM TONER PERFORMANCE

HDK® is a key component in powder toners. Even small amounts of HDK® can give your toner a competitive edge in delivering the crucial properties your customers require. The reason for its excellent performance lies in the special nature of WACKER's hydrophobic silica.

HDK® has an exceptionally high surface area in the range 50-300 m²/g. Depending on the surface modification HDK® for toners charges positive or negative vs. carrier powders. The products have defined primary-, aggregate- and agglomerate particle size distributions.

Properties of HDK®

- Synthetic amorphous inorganic additive
- Fluffy powder
- Neutral in color
- Thermally stable
- Highly hydrophobic
- Low residual silanol



OUR EXTENSIVE PRODUCT PORTFOLIO FOR THE TONER INDUSTRY

The toner industry is highly innovative. Not only toners powders but also carriers and machines are continuously being optimized. WACKER's silica as external additive contributes with its distinct and tailored properties. Our customers have improved printing efficiency, printing quality as well as cost and sustainability aspects in the focus.

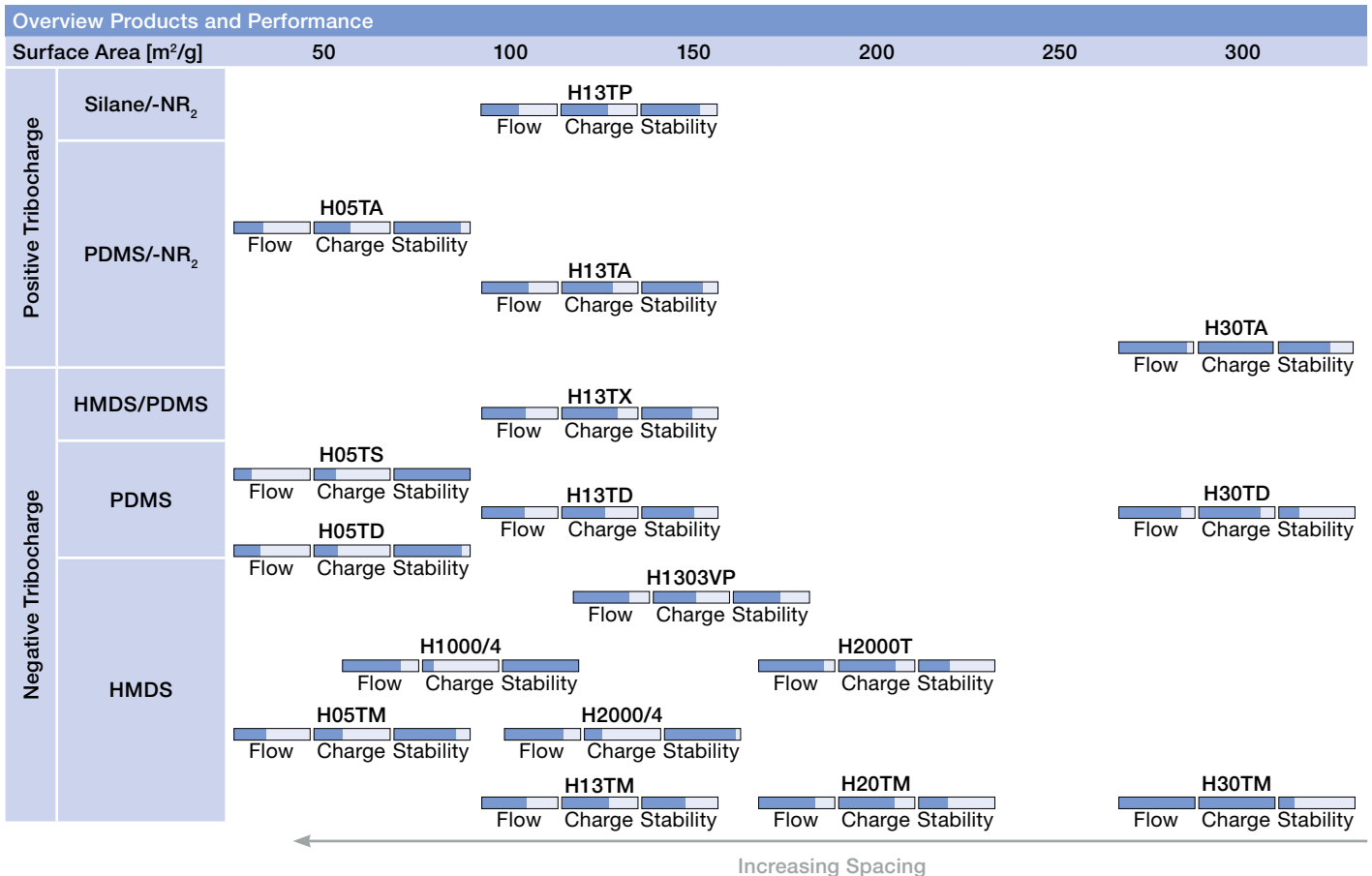
Silica additives aim on the toner's tribo electric charge, flow and stability profile. By using HDK®, these properties can specifically be adjusted. Manufacturers worldwide rely on our high-performing products.

WACKER's HDK® portfolio covers silicas having different particle sizes and surface areas along with several types of surface modification and functionalization. In addition, silica products may undergo structure modification, milling/de-agglomeration and classification steps. All this in combination makes it possible to draw on a wide spectrum of product properties.

Abbreviations and commentary:
 PDMS = Polydimethylsiloxane
 HMDS = Hexamethyldisilazane
 Flow = flowability of model toner/silica (sieving tower)

Charge = chargeability of model toner/silica vs. carrier (q/m-meter device)
 Stability = derived from chargeability of model toner/silica vs. carrier in L/L and H/H conditions (q/m-meter device)

Qualitative representation:
 overview provides information on the potential influence of HDK® products on toner properties



HDK® PRODUCTS FOR THE TONER APPLICATION

WACKER's product portfolio can be grouped according to the type of surface treatment, surface areas and charge-ability (negative or positive tribocharge vs. carrier). The HDK® products for toners

are based on surface areas in the range of 50-300 m²/g and provide negative or positive tribocharge vs. carrier powders – depending on the surface treatment applied.

Abbreviations:

PDMS = Polydimethylsiloxane

HMDS = Hexamethyldisilazane

HDK® Products with Negative Tribocharge					
HDK® Product	Surface Area Hydrophilic [m ² /g]	Tamped Density [g/l]	Carbon Content [wt%]	pH	Surface Treatment
H05TS	approx. 50	approx. 120	approx. 4.0	4-7	PDMS
H05TD	approx. 50	approx. 70	approx. 1.5	4-7	PDMS
H13TD	approx. 130	approx. 60	approx. 3.0	4-7	PDMS
H30TD	approx. 300	approx. 60	approx. 5.5	4-7	PDMS
H05TM	approx. 50	approx. 100	approx. 1.0	5-8	HMDS
H13TM	approx. 130	approx. 90	approx. 2.0	5-8	HMDS
H20TM	approx. 200	approx. 60	approx. 3.0	5-8	HMDS
H30TM	approx. 300	approx. 50	approx. 3.5	5-8	HMDS
H13TX	approx. 130	approx. 60	approx. 3.0	5-8	HMDS/PDMS

HDK® Products with Positive Tribocharge					
HDK® Product	Surface Area Hydrophilic [m ² /g]	Tamped Density [g/l]	Carbon Content [wt%]	pH	Surface Treatment
H05TA	approx. 50	approx. 70	approx. 2.0	7-9	PDMS/-NR ₂
H13TA	approx. 130	approx. 70	approx. 4.0	7-9	PDMS/-NR ₂
H30TA	approx. 300	approx. 70	approx. 8.0	7-9	PDMS/-NR ₂
H13TP	approx. 130	approx. 40	approx. 2.5	7-10	Silane/-NR ₂

STRUCTURE MODIFIED HDK® PRODUCTS

Silica for the toner application shall spread on the surface of toner particles. In the additive blending step, silica agglomerates break up into smaller units upon a certain energy input and evenly coat the particles. Structure modified HDK® sets high standards here with regards to handling and dispersability.

Structure modification is a mechanical process that is applied to a set of HDK® products. The process breaks-up aggregate particle moieties. The tendency to form extended silica agglomerate networks by particle-particle interaction is thereby reduced.

Consequently, resulting products are particularly easy to disperse as fewer particle-particle interactions are to be overcome in the additive blending step.

Furthermore, such products undergo a milling/classification step that further contributes to an even distribution of silica particles over the toner's surface. Structure modified products reveal increased bulk densities. Compared to other silica products the powders are easier to handle, create less dust and consume less space in the warehouse.

Structure Modified HDK® Products with Negative Tribocharge					
HDK® Product	Surface Area Hydrophilic [m ² /g]	Tamped Density [g/l]	Carbon Content [wt%]	pH	Surface Modification
H1000/4	approx. 90	approx. 230	approx. 2.0	4-9	HMDS
H1303VP	approx. 150	approx. 180	approx. 2.5	6-9	HMDS
H2000/4	approx. 130	approx. 210	approx. 2.5	7-9	HMDS
H2000T	approx. 200	approx. 180	approx. 3.0	6-8	HMDS

PERSONAL SUPPORT INCLUDED

We Are Here to Help You Get Perfect Results

Individualized Support

The HDK® team's holistic approach supports you by taking into account the various factors that determine your success.

Technological Factors

Many factors are involved in selecting the right grade of HDK® for the best performance. The composition and production method of your toners and its properties must all be considered. We support you with technical

recommendations, studies in our labs, and by supporting the lab or production trials in your plant. You can benefit from over 50 years of silica expertise and highly qualified experts.

Local Presence and Common Language

Local support is at hand with our technical service and WACKER Academy training centers. Our staff located in your region and time zone can advise you in your own language.

Regulatory Compliance

HDK® is compliant with major substance inventories worldwide. This includes registrations under Regulation (EC) No. 1907/2006 (REACH), covering supply of HDK® to the European Economic Area by Wacker Chemie AG and its affiliates.

Personal Support

Our HDK® team gives you access to qualified experts you can approach directly. We foster a culture of long-term expertise, relationship and continuity.



HDK® – MADE BY WACKER – WITH SUPERIOR SERVICE AND HIGH FLEXIBILITY

Expanding our Global Presence

Superior service, high flexibility

WACKER's state-of-the-art facilities in Europe and China produce a variety of pyrogenic silica grades, including nutritional and pharmaceutical products. Furthermore, our newest production was brought on stream in Charleston, TN, USA, in 2019. With an annual capacity of about 13,000 metric tons, the new facility will be a key component of the Charleston site, which produces polysilicon for the solar and semiconductor sectors. By using the synergies of the Polysilicon and HDK® production, WACKER can achieve maximum flexibility, less waste

and enhanced efficiency. This facility will open up new avenues for customers seeking an on-shore supplier in North America.

Optimal Packaging, Optimal Performance

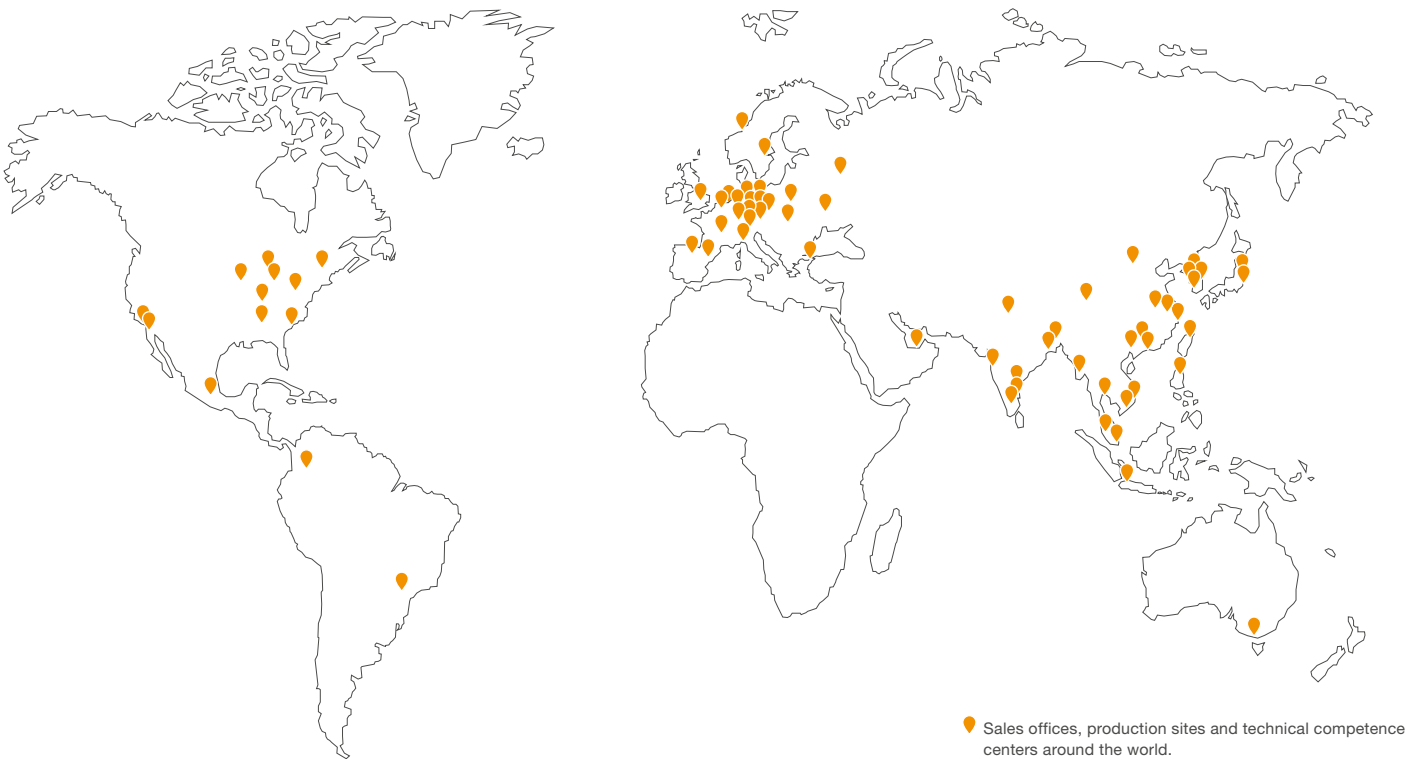
In order to ensure maximum effectiveness of your products and formulations, we offer various forms of packaging, to suit your logistics and workflow requirements. Packaging size, effective moisture protection, and your specific requirements are important factors in determining the optimal HDK® packaging for your productivity.

Pallets with Paper Bags

HDK® is available in multilayer, valved paper bags which can accommodate 5 to 20 kg of product, depending on bulk density. The bags are delivered on pallets, that are shrink-wrapped with a polyethylene film for moisture protection. If the shrink film is damaged accidentally or single bags are removed, it is advisable to protect remaining or individual bags either by wrapping them in plastic or adopting other appropriate measures.

Please contact us for further information.

EXPERTISE AND SERVICE NETWORK ON FIVE CONTINENTS



WACKER is one of the world's leading and most research-intensive chemical companies, with total sales of €6.21bn. Products range from silicones, binders and polymer additives for diverse industrial sectors to bioengineered pharmaceutical actives and hyperpure silicon for semiconductor and solar applications. As a technology leader focusing on sustainability, WACKER promotes products and ideas that offer a high value-added potential to ensure that current and future generations enjoy a better quality of life, based on energy efficiency and protection of the climate and environment.

Spanning the globe with 4 business divisions, we offer our customers highly-specialized products and comprehensive service via 26 production sites, 23 technical competence centers, 14 WACKER ACADEMY training centers and 52 sales offices in Europe, North and South America, and Asia – including a presence in China. With a workforce of some 14,400, we see ourselves as a reliable innovation partner that develops trailblazing solutions for, and in collaboration with, our customers. We also help them boost their own success. Our technical competence centers employ local specialists, who assist

customers worldwide in the development of products tailored to regional demands, supporting them during every stage of their complex production processes, if required. WACKER e-solutions are online services provided via our customer portal and as integrated process solutions. Our customers and business partners thus benefit from reliable service and comprehensive information to enable projects and orders to be handled fast, reliably and highly efficiently. Visit us anywhere, anytime around the world at: www.wacker.com






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