



## Process Technology for Digital Inks

Complete Program for Process Engineering of Decorative, Packaging & Functional Inkjet

# DIGITAL INKS

### Everything at a Glance

Integrated Solutions –	
A Complete Portfolio for Digital Inks .	4

Main Digital Inks Applications

Ceramic	Inkjet	 	 	 C

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## When you want a little more ...

If you were to look around now, you would find many objects that have been printed with inkjet technology.

For years, the Ceramic Industry has used digital printing to decorate tiles using pigmented ceramic ink. Other industrial sectors such as textiles, packaging, glass, functional electronics, amongst others, are also using the technology more and more.

The process of manufacturing digital inks is not just about ultrafine grinding of suspended particles to sub-micron or nanometer range. It has many more complex processes, such as wetting out, solid / wet mixing, chemical additive interactions, stabilisation, homogenisation, and obviously the fine grinding for the required particle size distribution.

Our accumulated experience and expertise in this application allows us to select the best solutions from our wide portfolio. Our technology is engineered to cover the different stages of ink manufacturing, and the specific requirements of each type of ink.

Hundreds of customers worldwide are guaranteed confidence for the thousands of tons of digital ink produced on NETZSCH equipment.

### Proven Excellence.



## INTEGRATED SOLUTIONS A COMPLETE 360° PORTFOLIO TO

BY CHEMICALS	DIGITAL INKS	BY APPLICATION		
Water Based	Ceramic Inkjet	Ceramic Tiles InGlass Glazes & Effects		
Solvent Based	Textile Inkjet	Pigment Dye Sublimation Direct Dyes		
"ECO" Solvent				
UV Cured UV Hybrid	Industrial & Commercial Inkjet	Packaging Publishing Surface Decoration Wide Format Security		
Hot Melt	Additive Manufacturing	Add Manufacturing Electrical Matjet		
Electrophotography	Dry Toner	Liquid Toner		
Inkjet	Drop on Demand	Continuous Inkjet		

## COVER ALL STEPS IN DIGITAL INK MANUFACTURING



## CERAMIC INKJET

There is no question that ceramic inkjet printing processes revolutionized the manufacturing of decorated tiles.

Since the very beginning, NETZSCH has been pivotal in the development of ceramic inkjet technology. The first batch of pigmented ceramic inkjet was produced in December 2005 using a NETZSCH *LABSTAR* laboratory mill. Since then, we have been at the forefront of this technology and the first point of contact. The System *ZETA®*, with an 80 % market share, is the renowned milling system in the industry for the wet grinding of ceramic inkjet inks.

NETZSCH is known worldwide for offering complete solutions for many ceramic applications, not just for ceramic inkjet inks. NETZSCH provides the perfect combination of machines and engineering technology for dry and wet processing of ceramic raw materials, pigments, frits and additives, as well as in-glass inkjet inks, digital glazes and effects.

## CERAMIC INKJET APPLICATION RESULTS

### successfully implemented

Ceramic application	Product	Working capacity [kg/hr]	Pigment concentration	Quality [µm]	NETZSCH solution
InGlass	Frits	43 grinding paste	70 %	d <sub>99</sub> < 1.39	Zeta® 10
Glaze Effects	Frits	120 grinding paste	40 %	$d_{95} = 3.3$	Zeta® 10
Ceramic tile	Ceramic pigment	85-150		d <sub>50</sub> = 0.5-0.8	s-Jet® 1000

### Complete program for Process Engineering of

- Digital Glaze
- Ceramic InkjetCeramic Pigments
- InGlass Ceramic Inks
- Technical Ceramics
- Minerals and Raw Materials
- Ceramic Masses

### System example with wet mills ZETA® and Steam Jet mill s-JET®



## TEXTILE INKJET

The printing of textiles has changed over the years. Screen-printing has been the primary selection for printing, but the use of digital printing is growing quickly.

Digital technology has already become a strong favourite for major textile applications such as fast fashion, displays & banners, apparel fabrics, household and technical textiles.

The majority of digital printing on textile is on polyester fabrics using dye sublimation and NETZSCH Grinding & Dispersing machinery leads the way in the preparation of these inks, as well as the pigmented inkjet inks, which are increasingly in demand.

Since the very beginning, NETZSCH has always been there, helping and learning together with our customers, through the development of new textile inkjet inks. No matter where in the world, our wide network of specialists and services are ready to support them.

## TEXTILE INKJET APPLICATION RESULTS

### successfully implemented

Textile application	Pigment	Working capacity grinding paste [kg/hr]	Pigment concentration	Quality [µm]	NETZSCH solution
Dye sublimation transfer	Black	7	28 %	d <sub>99</sub> < 0.2 + filtration	Neos® 10
Dye sublimation transfer	Magenta	3.5	37 %	d <sub>90</sub> < 0.18 + filtration	Zeta® 10
Dye sublimation transfer	Cyan	13	20 %	d <sub>99</sub> = 0.25 + filtration	Zeta® 60
Dye sublimation transfer	Brown	25	30 %	d <sub>90</sub> < 0.18 + filtration	Zeta® 25
Pigmented	Black	68	20 %	filtration	NEOS® 10
Pigmented	Cyan	25	25 %	filtration	NEOS® 10
Pigmented	Yellow	36	29 %	filtration	NEOS® 10

### Complete program for Process Engineering of

- Disperse Dye Sublimation
- Disperse Dye Direct
- Pigmented Inks
- Acid Inks
- Reactive Inks

### Example line with ALPHANEOS NElast design and EPSILON inline disperser



## INKJET PACKAGING

Anyone who has strolled through the Printing Industry exhibitions will have noticed that there is a lot of interest in the possibilities of digital printing for packaging.

Printing digital inks onto different substrates such as corrugated and folded cartons, labels and flexible packaging, is becoming more and more common.

New technologies demand new inks, and NETZSCH, as always, with its complete program of Grinding & Dispersing technology, is ready and able to help inks producers find the optimal process for each specific case.

### PACKAGING INKJET APPLICATION RESULTS successfully implemented

Packaging application	Pigment	Working capacity grinding paste [kg/hr]	Pigment concentration	Quality [µm]	NETZSCH solution
UV led corrugated carton	Yellow	55	25 %	d <sub>90</sub> < 0.09 + filtration	Neos® 10
UV led corrugated carton	Cyan	43	25 %	d <sub>90</sub> < 0.09 + filtration	Zeta® 10
UV led corrugated carton	Magenta	52	25 %	d <sub>90</sub> < 0.09 + filtration	Neos® 10
UV led corrugated carton	Black	50	25 %	d <sub>90</sub> < 0.09 + filtration	Zeta® 25
UV led corrugated carton	White	20	65 %	filtration	Zeta® 25

### Complete program for Process Engineering of

- Corrugated Carton
- Folded Carton
- Flexible Labels
- Water Based Inks
- Solvent Inks
- Eco Solvent Inks
- UV Inks

## Example line with wet mill *ALPHANEOS* and *EPSILON* inline disperser including final UV formulation and adjustment



# INDUSTRIAL & COMMERCIAL INKJET

FKF4318175

TO THE TREASURY

# TIROUGHOUT

Digital printing is also breaking through sectors formerly bound to more traditional, industrial printing, such as commercial printing, security inks, surface decoration, wood, wallpaper, photobooks and many others.

Printing using inkjet provides flexibility, personalization, and cost savings among other advantages. Liquid toner and other new ink technologies are also increasing their share of the digital printing market.

Printing and ink technologies are evolving, and this brings very diverse inks and substrates, each of them with their own technical requirements and individual needs. NETZSCH mills, dispersers, and classifiers are evolving to meet these innovations. The digital market is not going to stop, and all players have to live up to the new demands.

### INDUSTRIAL INKJET APPLICATION RESULTS successfully implemented

Industrial application	Pigment	Working capacity grinding paste [kg/hr]	Pigment concentration	Quality [µm]	NETZSCH solution
Continuous Inkjet	Black	26	20 %	d <sub>90</sub> < 0.3	<i>Zeta</i> <b>®</b> 10
Deco paper	Iron oxide	30	27 %	d <sub>50</sub> = 0.115 + filtration	Neos® 10
Deco paper	Yellow	50	21 %	$d_{_{90}} = 0.2$ + filtration	Neos® 10

### Complete program for Process Engineering of

- Publishing Inks
- Surface Decoration Inks
- Wide Format Inks
- Security Inks

### System example with With ALPHANEOS and EPSILON inline disperser



## ADDITIVE MANUFACTURING

Inkjet applications are a fast-growing and dominant trend in the digital inks industry. In particular, the 3D-printing market is currently experiencing a period of very rapid growth.

An ever-increasing number of applications in the automotive and aircraft industries, tool manufacturer and prototype development are using more and more additive manufacturing technologies.

NETZSCH's extensive machine portfolio includes excellent solutions for classifying the metal powders required for high quality applications of "Additive Manufacturing" and 3D-printing.

### METAL POWDER DEDUSTING

### successfully implemented



excess air from the closed loop system.

## MACHINES FOR DIGITAL INKS PROCESSSING





## DRY GRINDING & CLASSIFYING

Optimized formulation and grinding of pigments is essential to achieve a color with narrow particle size distribution

### Impact on the Production Process and End Product

- Increase the capacity of the wet grinding system
- Reduction in the overall costs of the production process (wet & dry)
- Achieve higher quality compared to processing without this previous step



### CGS Fluidized Bed Jet Mill

The jet mill with the ConVor  $^{\circ}$  classifier wheel for a fineness of to  $d_{_{97}}$  < 4  $\mu m$  - 5  $\mu m$ 

### s-JET<sup>®</sup> Steam Jet Mill

Revolutionary patented high-pressure system (40 bar) for a fineness of to  $d_{_{97}}$  < 1,2 µm (ceramic inkjet).

Working pressure 40 bar. Steam temperature 250°C - 350°C In addition, moist products can be ground and dried simultaneously without any additional pre-drying process for the inlet. Energy efficient processing of other raw materials (enamel, zirconium, etc.)

#### SpheRho® Dry Agitator Bead Mill

When fine grinding of powders is required at a low energy consumption, *SPHERHO®* is the solution.

It operates with small grinding beads, at high stress intensity, giving high throughputs at a fineness in the range of 2-8 microns. The decades of very well proven technology of NETZSCH wet grinding has been now successfully implemented in dry process applications



#### CONDUX<sup>®</sup> Impact Mill

A high speed fine impact mill normally equipped for this application with Pin Mill grinding tool. Allows for the dry grinding of products up to a Mohs hardness of 3 - 3.5

### CFS/HD-S High-efficiency Fine Classifier

This high efficiency air classifier was developed for ultra-fine, sharp separation, and is often used in conjunction with grinding plants. The optimized classifier wheel geometry produces the finest cut points and high yields that have not been possible with production scale conventional one wheel air classifiers.

The special dispersion zone directly in close proximity to the classifier wheel uses clean gas to efficiently disperse the material to be classified.







## MIXING & DISPERSION

*Do not underestimate pre-dispersion. It has a direct impact on the fine grinding process* 

### Multiple Processes in One Step

- Solid feed into liquid phase
- Wetting out pigment surfaces and dispersing agents & additives
- Liquid & additive mixing & homogenization
- Deagglomeration for finer particle sizes

#### **EPSILON Inline Disperser**

Compact solution for producing homogeneous dispersions with reproducible quality in an inline process. Here, the dispersion process takes place in an atmospherically sealed processing chamber and is thus dust and emission free.

The *EPSILON* operates similarly to a feed pump. Through optimal flow control, a negative pressure is created in the processing chamber during operation. This negative pressure is used to draw in the powder, whereby, in combination with appropriate powder delivery, introduction of external air is minimized.

The principle of the *EPSILON* is based on the introduction of the powder under negative pressure in a continuous, large liquid surface. Due to the pressure gradient between the supply and delivery sides, the liquid is pressed into the agglomerate structure such that, within a very short period of time, the individual particles of the solid are almost ideally wetted. Because of the low shear rates, the energy input is significantly lower than for conventional rotor-stator systems, which means that a smaller increase in the product temperature is achieved.



#### **OMEGA®** Inline Disperser

Successful dispersion requires targeted force in order to separate agglomerated particles. The *OMEGA®* Economic Disperser applies dispersive forces then and there, where they are especially effective: in the *OMEGA®* disperser body, energy is transformed into very high speeds under pressure. Turbulence and cavitation in perfect combination with specifically-applied shearing forces ensure maximum dispersion results. In addition, the system can be easily adapted to different operating conditions or formulations thanks to the *OMEGA®* disperser body, which consists of a nozzle with infinitely adjustable flow properties. The optimum adaptation and increased efficiency not only lead to reduced energy consumption in the production process and thereby less heat development, but also to less wear as compared to traditional technologies.



#### MAXSHEAR Inline Disperser

Compact enough to be included at virtually any point in your process. The self-pumping portable unit features rotor/stator based technology with multiple stator configurations available. Manufactured to extremely precise tolerances to eliminate product bypassing typical of other single stage dispersers. Exceptional high shear performance and powerful pumping action makes the *MaxShear* ideal for emulsifying and processing hard-to-wet materials.

## WET PRE-GRINDING

After dispersion and prior to the wet grinding, when product requires extra...



### Discus<sup>®</sup> Grinding System (formerly LME)

With the *Discus*<sup>®</sup> grinding system, the movement of the grinding media between the disks is activated and optimized. This leads to a high power input and a grinding efficiency with low specific energy consumption and an uniform impact intensity. With an optimized Dynamic Classification rotor, high throughput rates are achieved.





#### MaxSHEAR Inline Disperser

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## WET GRINDING

NETZSCH will help to select the optimal fine grinding system configuration for your specific product and requirements.

### Main Goals

- Obtain a fine pigment dispersion into the  $d_{50}$  fineness which meets the requirement Allowing wet out of all the pigment surface with solvents and chemical additives
- Obtain a PSD as narrow as possible\* (\*application dependent)
- Keep T (temperature) below max.
- Remove agglomerates and/or coarse particles from ink
- Maintain viscosity within specifications



### Grinding System ZETA®

- Peg grinding system with the highest grinding intensity
- Finenesses into the nanometer range
- Narrowest particle size distribution
- Greatest cost efficiency
- Exact reproducibility
- Effective centrifugal separation system
- Logical design for the highest throughput rates Ideal for circulation/multipass operation
- Optimal energy input with effective cooling
- Ideal temperature control
- Universally applicable for every product
- Scale-up possible from laboratory to production machine
- Reliable use of a wide variety of grinding media from 0.1 mm to 3 mm
- You achieve the best product qualities with maximum output and optimal energy efficiency

#### Grinding System NEOS®

- Maximum slotted pipe surface area
- 2 Optimized grinding media separation
- 3 Maximum cooling surface to grinding chamber volume ratio
- 4 New rotor design for efficient power input
- 5 Optimum grinding chamber cooling with NETZSCH-CERAM C inner tank and optional rotor cooling







## LABORATORY MACHINES

For development of new products, for processing small quantities, for quality control and process optimization ...



### LABSTAR Laboratory Agitator Bead Mill

Enables scientific academic work on difficult research and development tasks. Impresses with its easy handling.

The laboratory mill *LABSTAR* enables an exact scale-up to comparable production machines.

*Neos®*, *Zeta®* and *Discus®* grinding system are available in different grinding chamber designs (NETZSCH-*Ceram C*, NETZSCH-*Ceram N*, NElast, NETZSCH-*Ceram A*, Cr-Ni-steel)



#### MIICROSERIES Laboratory Agitator Bead Mill

Finest wet grinding technology – the laboratory mills of the *MicroSeries* are an investment in the future for new product developments.

The improved centrifugal separation system of the worldwide known peg grinding system *ZETA®* enables the use of very small grinding media for grinding and dispersing of minimal product quantities.



#### LABCOMPACTPLUS. The Module Plant

The NETZSCH *LaBCOMPACTPLUS* is available with different laboratory machines, e.g. the High-efficiency Fine Classifier CFS 5 HD-S. The plant comprises a very compact operating module including feeding, cyclone, filter, blower and electrical control. It is mounted on one single base frame and is delivered completely installed. The *LABCOMPACTPLUS* is especially designed for use in laboratories. The technology of production-size plants which has been channeled into the design of this product guarantees a stable and reproducible processing method.



## Business Unit Grinding & Dispersing – The World's Leading Grinding Technology

NETZSCH-Feinmahltechnik GmbH Selb, Germany

NETZSCH Trockenmahltechnik GmbH Hanau, Germany

NETZSCH Vakumix GmbH Weyhe-Dreye, Germany

NETZSCH Lohnmahltechnik GmbH Bobingen, Germany

NETZSCH Mastermix Ltd. Lichfield, Great Britain

NETZSCH FRÈRES S.A.R.L. Arpajon, France NETZSCH España, S.A.U. Terrassa/Barcelona, Spain

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The NETZSCH Group is a mid-sized, family-owned German company engaging in the manufacture of machinery and instrumentation with worldwide production, sales, and service branches.

The three Business Units – Analyzing & Testing, Grinding & Dispersing and Pumps & Systems – provide tailored solutions for highest-level needs. Over 3,500 employees at 210 sales and production centers in 35 countries across the globe guarantee that expert service is never far from our customers.

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