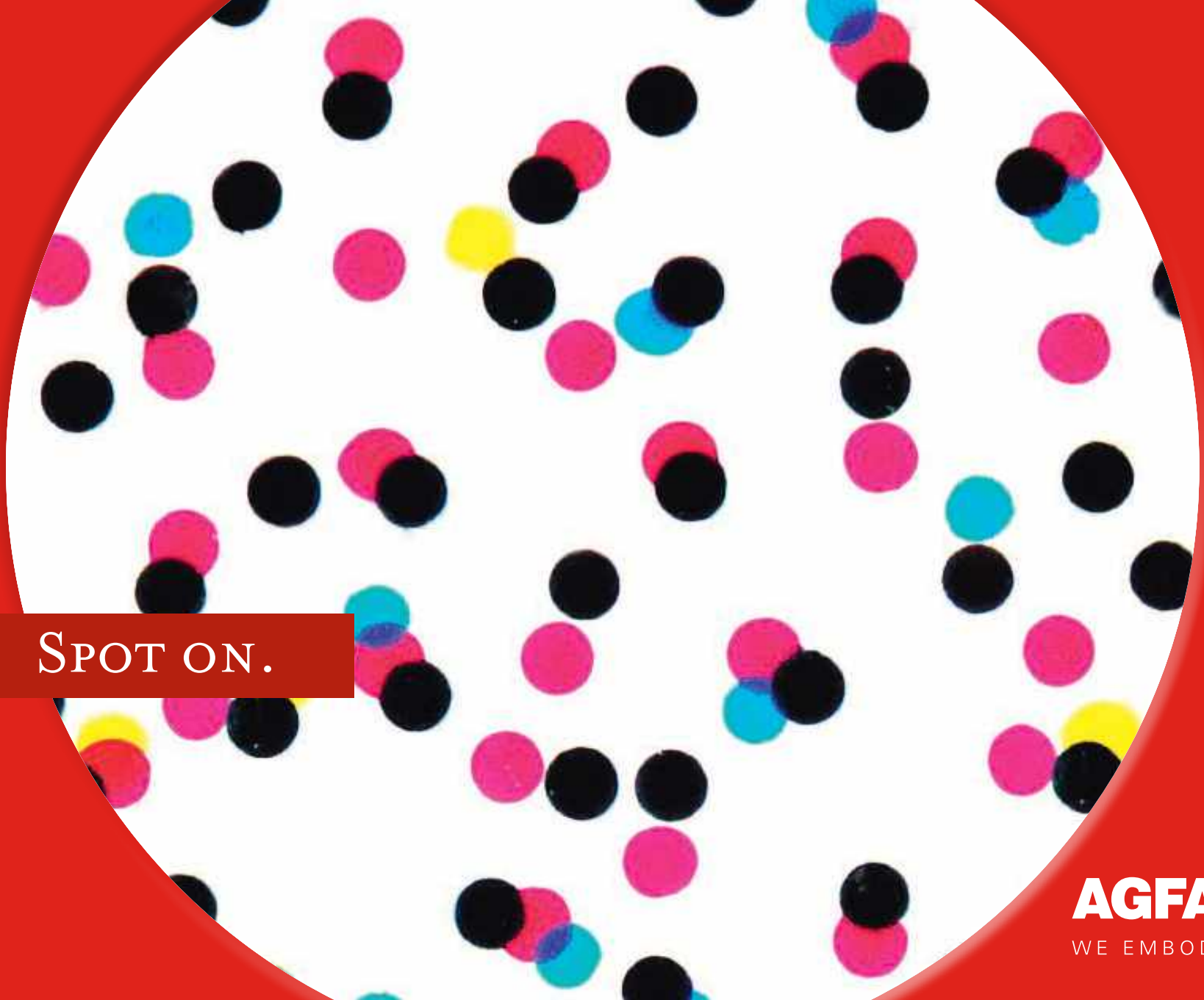


Spot on.

AGFA

WE EMBODY PRINT

SPOT ON.

A guide to Agfa's high-performance UV inkjet inks.

www.agfagraphics.com

Table of contents

UV curing process

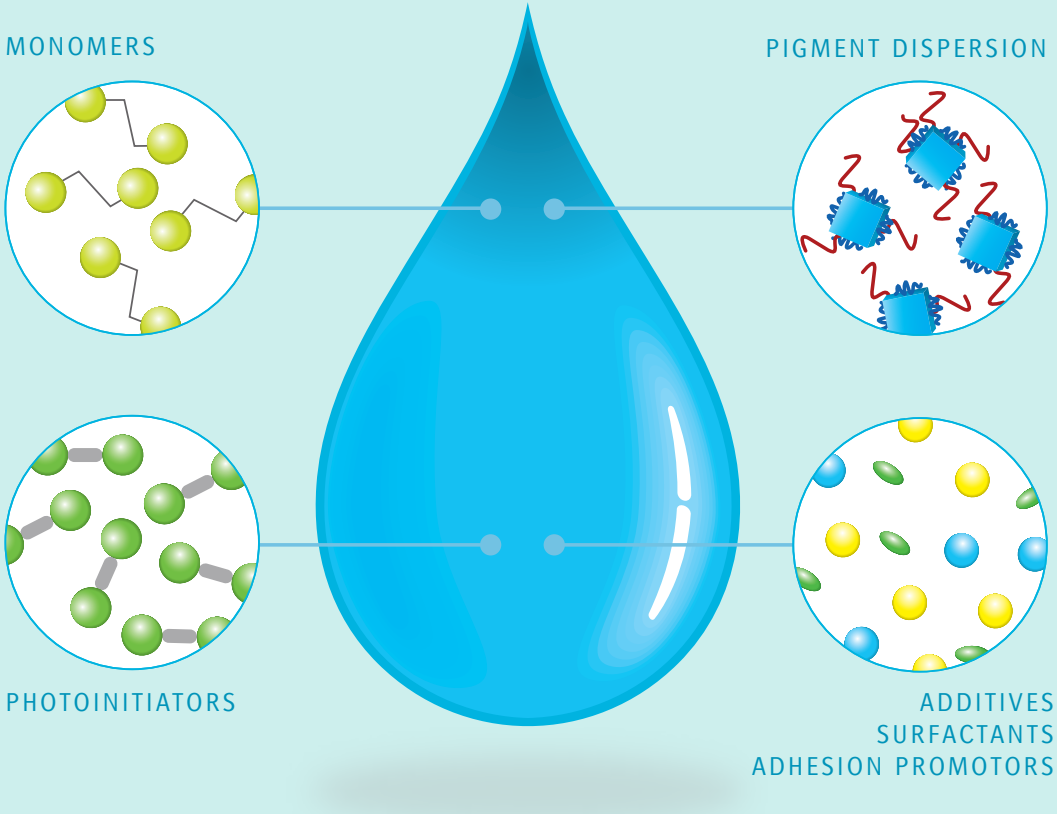
The power of UV-curable inks

Just as great paintings start with the right choice and treatment of pigments, excellent prints begin with the best possible ink solutions. In order to create printed masterpieces, you need ink formulations with perfect pigment dispersion, viscosity, jetting performance, color value, surface tension, and image durability. In short: you need the perfect ink solution.

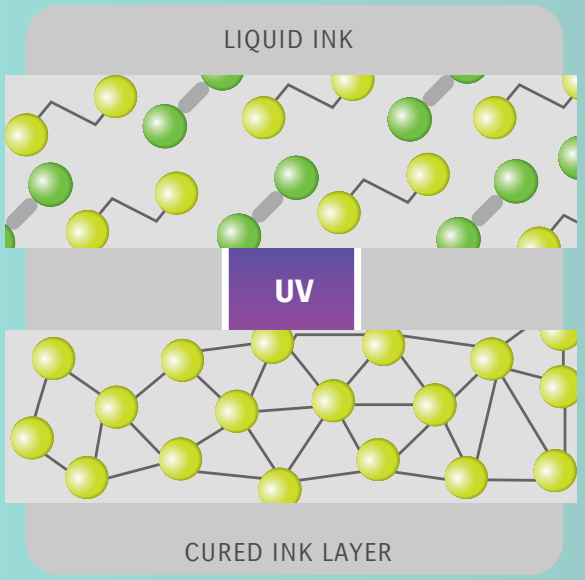
UV-curable inks are the elite class among top-quality inkjet ink formulations. Based on ultraviolet curing technology, these inks are instantly dried by rays of UV light. As a result, printed media are immediately ready for further handling.

UV-curable inks have distinct advantages over other ink solutions, such as improved adhesion, better abrasion and chemical resistance, and superior consistency and reliability. UV curing also conveniently eliminates the need for solvent evaporation or any special layers upon printing substrates and it does not involve VOC emissions.

UV INKJET INK COMPOUNDS



UV inkjet inks comprise the compounds necessary for the photochemical reaction that is started by the exposure to UV light: monomers and photoinitiators. The photoinitiators form radicals upon UV exposure, and these in turn start up the polymerization of the monomers. The UV ink derives its color from the pigment dispersion. Many additives are needed to realize all quality aspects, including surfactants, in-can stabilizers, adhesion promotors, etc. (see also the glossary on page 23).

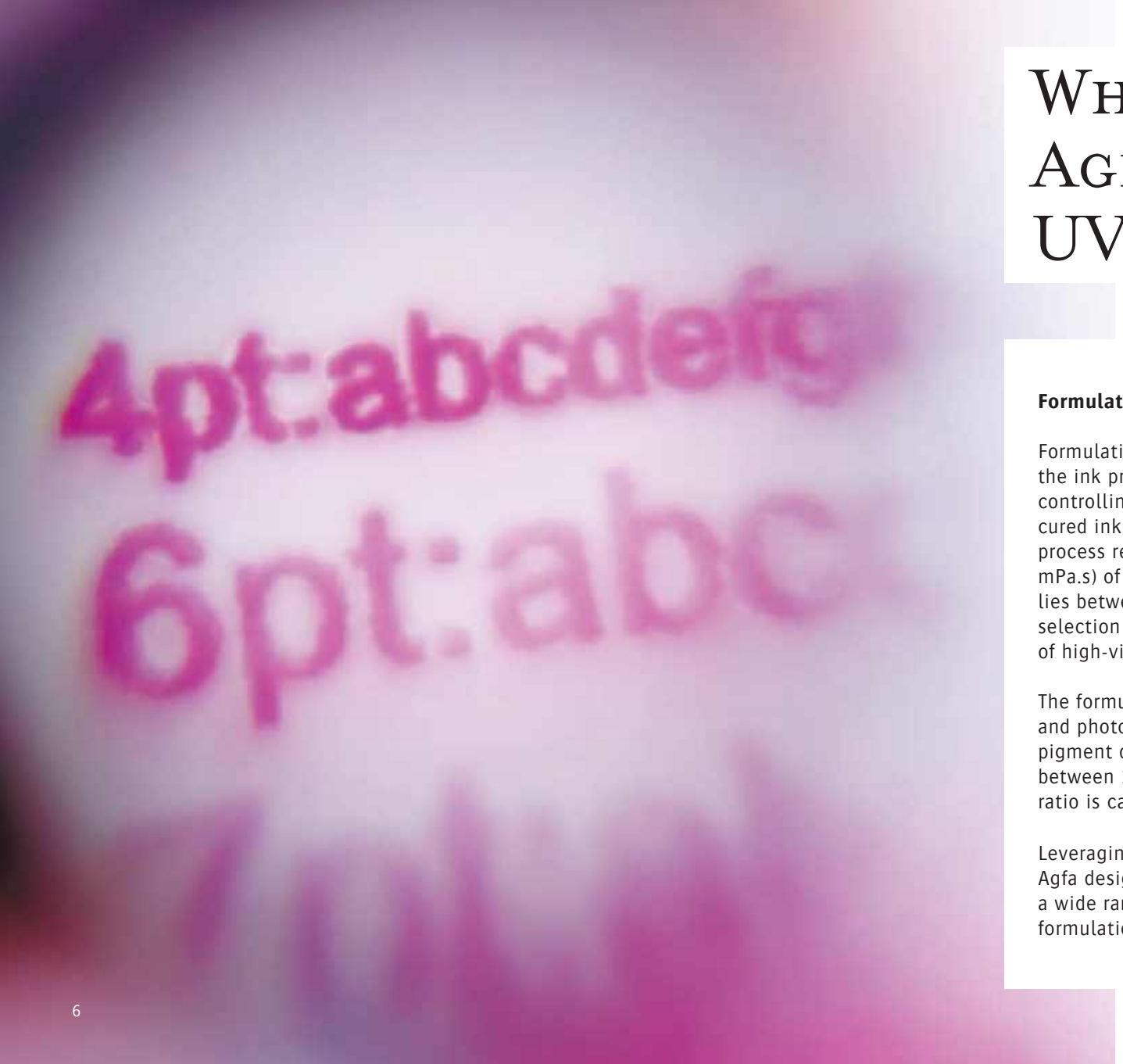


UV curing process

UV CURING

VS. THERMAL DRYING

Using UV light instead of heat, the UV curing process instantly deposits a hardened layer of ink onto the substrate. While conventional heat- and air-drying processes entail solvent evaporation, UV curing does not. Since UV curing also doesn't generate pollutants or cause coating thickness or volume loss, it results in higher productivity, more resistant results, and less waste and energy use.



Why choose Agfa's UV-curable inks?

Formulating UV inkjet inks

Formulating UV inks for inkjet typically requires tailoring the ink properties to the piezo jetting process, as well as controlling the photochemical reaction, so as to obtain a cured ink with outstanding physical properties. The jetting process requires low viscosity (typically between 6 and 15 mPa.s) of the ink at jetting temperature, which typically lies between 40 and 50°C. This strongly restricts the selection of ink compounds, and limits the concentration of high-viscous ink compounds to a low range.

The formulation requires combining a mixture of monomers and photoinitiators to meet all demands. Together with pigment dispersion surfactants, ink formulations comprise between 12 and 20 compounds, of which the concentration ratio is carefully tuned to deliver the required quality.

Leveraging years of experience and chemical knowledge, Agfa designs and develops high-performance UV inks for a wide range of applications. The resulting low-odor ink formulations produce sharp and high-quality images.

1 Lowest ink consumption on the market

Agfa UV inks are formulated from the very effective pigment dispersion to deliver wide color gamut with the lowest ink consumption on the market.

In addition to being both economical and eco-friendly, this results in a considerable advantage in terms of the cured ink layer's physical properties (e.g. adhesion, flexibility and scratch resistance).

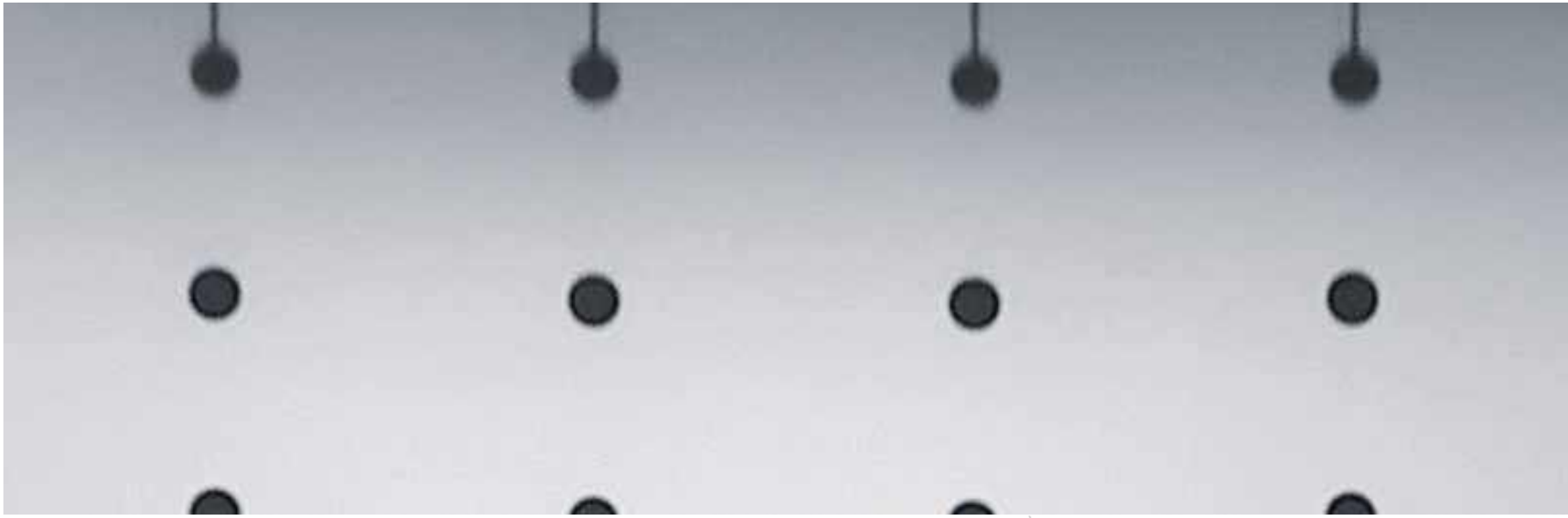
2 Consistent from batch to batch

Delivering batch-to-batch consistency is one of Agfa's main priorities. Our UV inks boast outstanding, stable jetting performance – including controlled ink drop formation, great ink latency and long-term jetting reliability.

Perfectly tuned to applications, piezo print heads and print system requirements, Agfa UV inks deliver identical results over and over again.

Longest shelf life in the industry

Thanks to their composition and pigment dispersion qualities, Agfa UV inks are number one when it comes to longevity. When stored under normal conditions, ink can be conserved for up to 24 months, depending on the ink set.



4 Unique ink technologies

Agfa UV inks are designed using highly innovative ink concepts. Agfa's Pigment Shield Technology, for example, is a patented pigment dispersion technology specifically for UV inks. It guarantees high color strength and ink stability, which also contributes to the ink's long shelf life. Thanks to our technological know-how, our ink formulations are optimized for lowest ink consumption for every industrial piezo print head. We offer full ink sets, which may comprise high-performing white ink and/or varnish.

5 100% customer-oriented inks

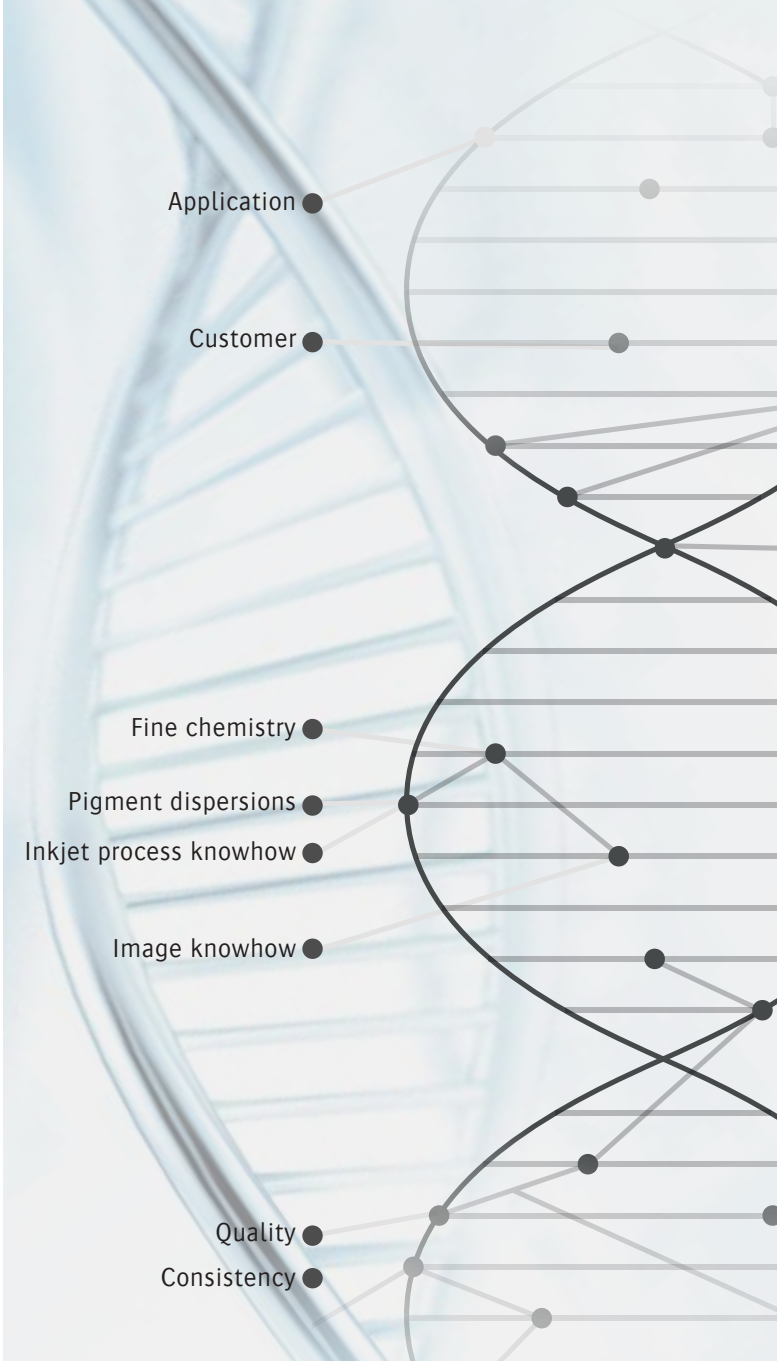
Developing customer-oriented inks that provide optimal functional performance is our main focus. Whether we are researching, developing, producing or testing our ink formulations, we always prioritize our customers and their needs. Tuned to specific and functional application requirements, Agfa UV inks offer tailor-made solutions.

UV ink technology – it's in our DNA

With nearly 150 years of experience in applying functional liquids to various substrates, we can proudly state that no other company can claim our level of expertise in ink development. It is truly part of our DNA.

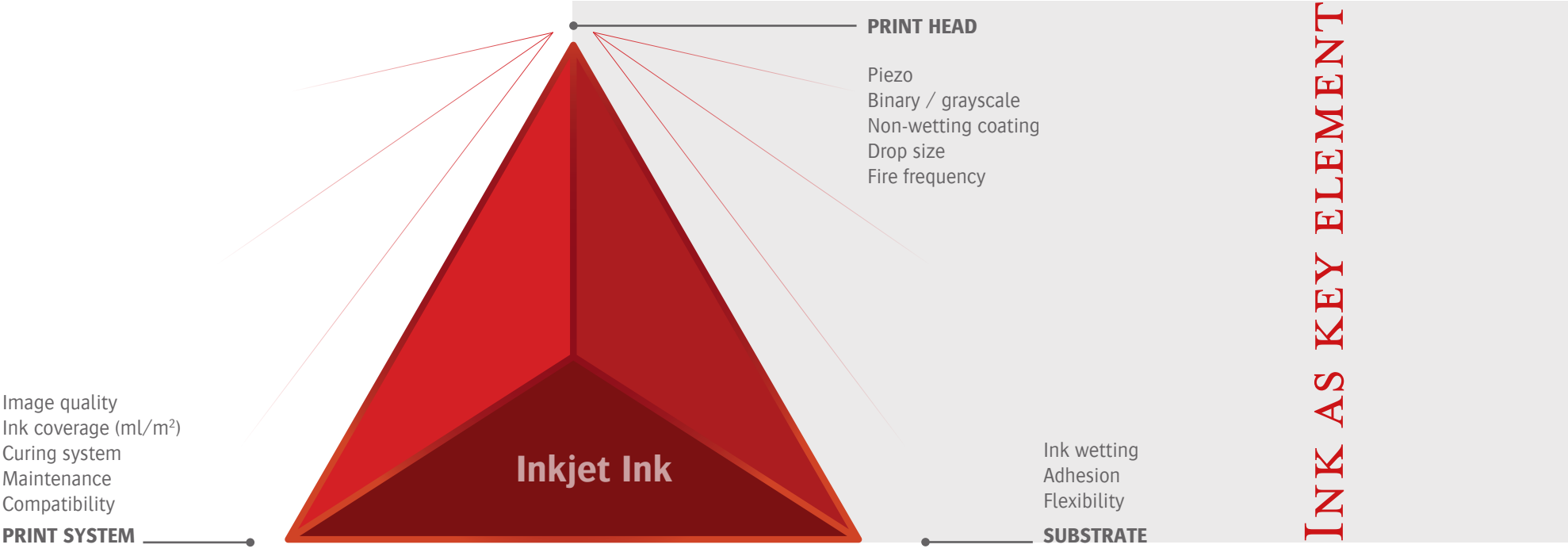
In-house expertise

Agfa UV inks are developed, tested, and manufactured in-house by professional teams that use only the latest technologies. We don't just invest in state-of-the-art equipment, tools and processes to develop and produce our high-performance ink solutions. Agfa also recognizes the importance of highly skilled people who are experts in pigment dispersion, ink wetting, jetting, curing, production and more.



From raw materials to print systems

Agfa takes its job to heart from beginning to end. We are the only ink partner that offers knowledge and expertise in all possible aspects of UV ink development and manufacturing. Our development processes are founded on the careful selection of raw materials, the use of highly advanced technologies, and a fast screening process of promising new ink formulations. We are trained in finding the best mixture of ink compounds to deliver optimal jetting performance as well as in an efficient process for quality control of the manufactured inks.



Moreover, Agfa does not manufacture a single set of inks without taking the entire print system into account. As part of the full ink development cycle, we optimize the jetting performance of our inks so that they work perfectly together with print heads, substrates and the entire print system. Thanks to our multidisciplinary teams that understand all processes of ink integration, Agfa UV inks help you achieve the best system performance.

Research & development

Agfa creates inks through an extensive process involving research, development, and testing. We have mastered the production of our palette of inks with both the mind of a scientist and the eye of an artist.

The development process of Agfa-made UV inks is truly unique. Adopting a pharmaceutical approach, Agfa develops its inks the same way medication is manufactured. Only by rigorously screening and testing every component, variable and possible formulation are we able to offer you such premium ink performance.

High-Throughput Screening

From the countless pool of ink formulations identified by Agfa, the most appropriate candidates are rapidly identified and selected according to specific criteria in our High-Throughput Screening (HTS) labs.

Thanks to automated HTS techniques, each and every combination is tested for viscosity, surface tension, color value, curing speed and more.

This allows for a reduction in the development time of new and promising ink formulations.

Developing ink formulations

The ink compositions selected via the screening process are further developed in our R&D labs. The resulting ink prototypes are tested for their performance in all possible ways. While jetting performance, for example, is tested using drop watcher systems, UV curing is carefully studied at various print speeds. All physical properties of the cured ink layers are measured in detail.

A portfolio of patents

For more than 20 years, Agfa has invested in extensive research and development to provide customers with innovative UV-curable inkjet inks. These inkjet inks are protected by a strong patent portfolio, which now surpasses 175 patent families and covers such topics as raw materials, pigment dispersions, ink formulations, ink production, and more.

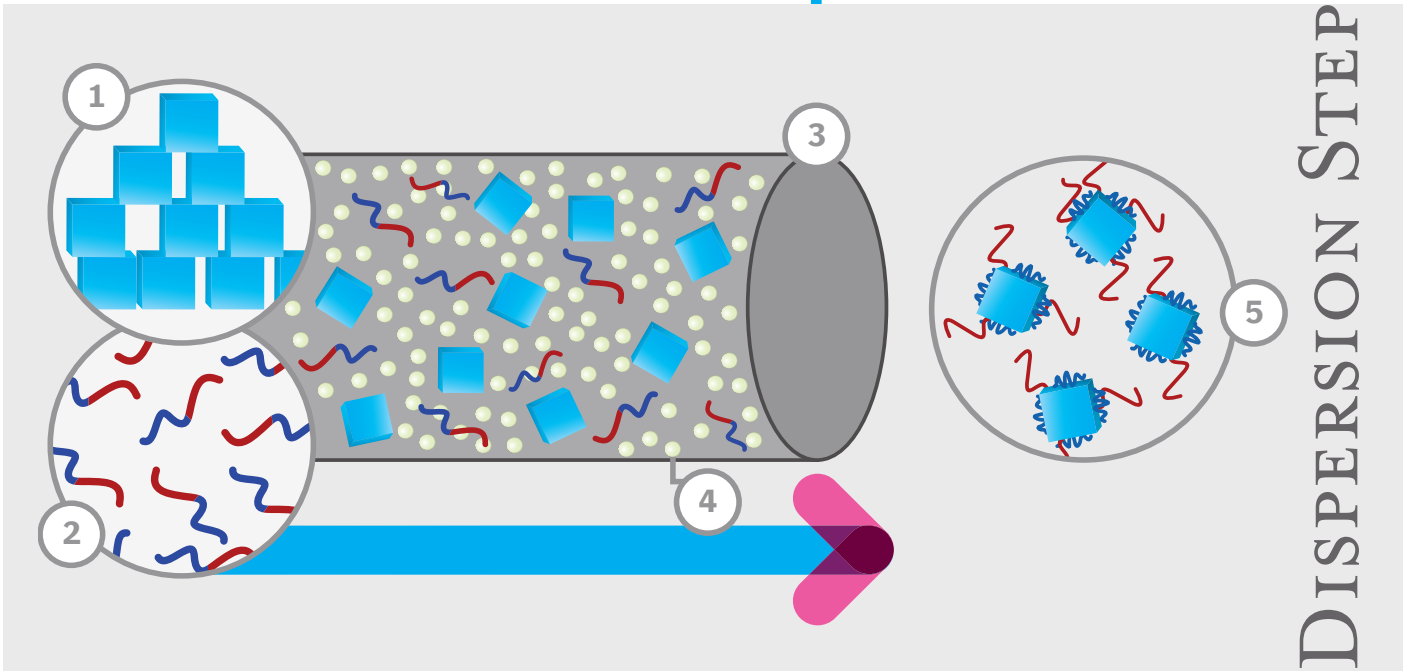
Drop watcher

Our UV ink production process

Pigment dispersion process

The pigment, consisting of particle agglomerates, is available in powder form and is not soluble in the ink carrier fluid (a monomer in case of UV ink). A stable, homogeneous pigment dispersion is obtained in three steps: wetting of the pigment, separation of the pigment particles (breaking the agglomerates into primary pigment particles) and stabilization of the primary pigment particles (preventing re-agglomeration).

To wet the pigment, a pigment slurry is created by combining the aggregated pigment particles, a polymeric dispersant and a monomer in a well-defined ratio. Subsequently, the pigment agglomerates are broken by milling the pigment slurry in a bead mill. Beads are catapulted against the pigment agglomerates in the slurry, causing the agglomerates to break up into primary pigment particles. The polymeric dispersant prevents the re-agglomeration of the primary pigment particles as its molecules occupy part of the pigment particle surface; since these molecules are large, they hinder each other and keep the stabilized primary particles at a distance from each other.



1. Agglomeration of pigment particles - 2. Polymeric dispersant - 3. Milling chamber - 4. Milling beads - 5. Pigment dispersion

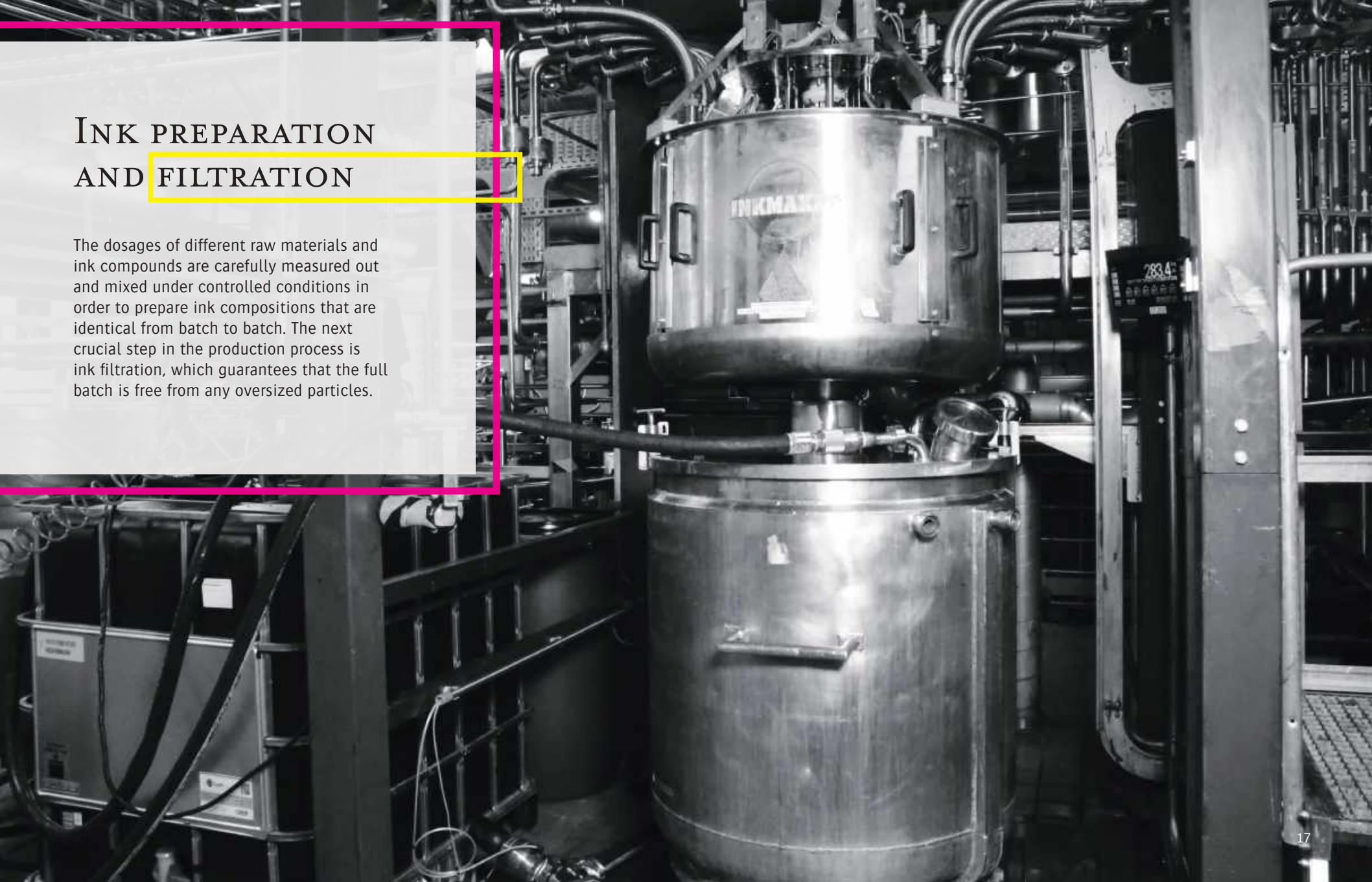

Milling beads

Concentrated pigment dispersion

Pigment dispersion is the first and most important consideration of the UV ink production process. Agfa's world-class pigment dispersion milling processes deliver pigment dispersions of superb quality with very fine and narrow particle size distribution. This advanced dispersion method is also one of the reasons why Agfa UV inks have such an extensive shelf life.

Ink preparation and filtration

The dosages of different raw materials and ink compounds are carefully measured out and mixed under controlled conditions in order to prepare ink compositions that are identical from batch to batch. The next crucial step in the production process is ink filtration, which guarantees that the full batch is free from any oversized particles.



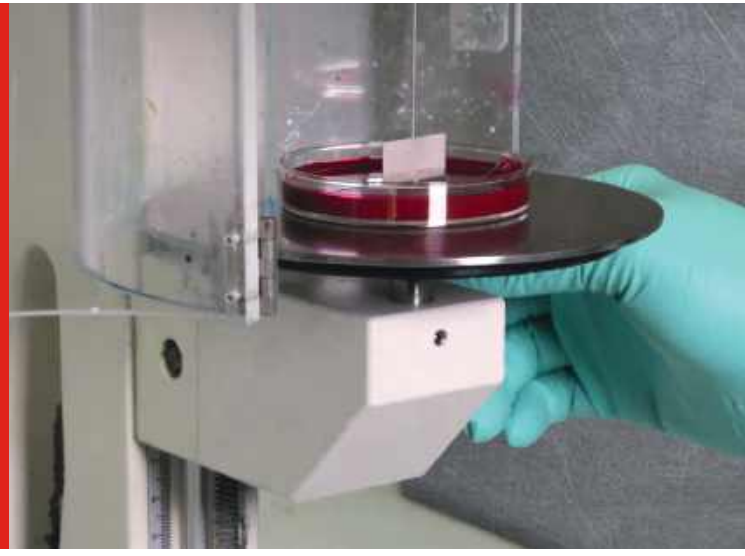
Filling and packaging

Agfa has invested in an advanced packaging and labeling line that allows for the precise and automated filling of specific, anti-contamination and UV-protective containers with its inks.
Every step of this filling process happens under perfectly controlled conditions. Agfa UV ink containers are carefully selected to enable the flawless preservation of ink quality and are sealed off by both a sealing film and a plastic cap.
This double closure ensures that the containers do not leak and the inks maintain their longevity.

Extensive quality control

>>
Measurement of ink viscosity
(at different shear rates and temperatures)

<<
Measurement of ink surface tension



Because we take quality control of our ink formulations very seriously, we extensively test the raw materials, pigment dispersions, jetting reliability, and other characteristics of each and every ink batch we produce. Nothing escapes our attention. Only when the ink parameters meet our strict requirements for quality and performance do we market the ink batch.

Agfa, responsable Ink Manufacturer

Health & Safety

Agfa controls the safety, health and environmental aspects throughout each stage of the product's life cycle, with regard to its own operations and to the use of its products by its customers. Agfa UV inks are compliant with applicable regulations such as diverse registration and notification duties, hazard communication obligations and restrictions on chemical substances. Agfa UV inkjet inks are used by customers to produce articles, which in turn are regulated in terms of composition and use.

Agfa informs its customers where requested on compliance with applicable regulations, standards, restricted substances lists.

Sustainability

Agfa is committed to reducing its environmental impact across all aspects of its business.

We critically examine environmental and safety issues throughout each stage of a product's life cycle, and the same goes for our approach to the research, manufacturing and testing of our UV ink solutions.

UV inkjet printing results in a significantly smaller environmental footprint compared to traditional printing techniques. In addition, Agfa UV inks are produced in state-of-the-art production facilities that conform to ISO9001 and ISO14001 environmental standards.

The future of inkjet printing

UV inkjet printing has proven to be the right technology for sign and display printing, and shows great promise for industrial applications including packaging and decoration printing. Committed to this technology and its promise for the future, Agfa will continue to research new and innovative UV ink formulations.

The field of digital inkjet printing is continuously growing and Agfa is driving the development of new technologies and applications with its high-quality UV-curable inks. We are constantly expanding our ink portfolio, introducing improved, customer-oriented inks with a dedication to outstanding performance.

The 'ingredients' of Agfa UV inkjet inks

Relying on Agfa means benefiting from our state-of-the-art technologies, years and years of in-house experience, and continuous development.

- 150 years of experience in imaging consumables
- In-house research, development and production
- State-of-the-art, patented technologies
- Consistent, customer-oriented ink quality
- Unique and quality-controlled ink performance
- Constant innovation and a future-proof approach

Glossary

adhesion	the degree to which an ink sticks to the surface of a substrate or an object (usually tested by a tape test)
agglomeration	the joining of pigment particles to form aggregates and larger particles which precipitate faster in the ink
color gamut	the complete range of colors that can be reproduced with a color ink set (also depends on the substrate)
drop formation	the process whereby the drops are jetted by the nozzles (orifices) in the nozzle plate of the inkjet print head
drop watcher system	system to study drop formation and analyze drops in flight (ink formulations and jetting conditions can be studied)
high-throughput screening	automated screening process allowing very fast screening of ink compounds and their ratio with regard to other ink compounds (note: HTS is largely used in drug-discovery processes)
jetting performance	total quality perspective of the jetting quality of the ink, comprising stability of drop formation, jet straightness, the degree of ink mist formation, the amount of satellites, as well as jetting reliability over time
latency (or open head time)	length of time that the ink can remain idle (print head stays operational but doesn't jet) within the nozzles of the print head before printing results in missing nozzles (no ejection)
UV LED	ultraviolet light-emitting diode: a compact solid-state UV source, emitting a narrow band of radiation (most common is 395 nm wavelength)
monomer	a molecule that can combine with others of the same kind to form a polymer; for UV inkjet inks most common monomers are acrylates, as the double bonds of the acrylates are very reactive towards the polymerization reaction induced by radicals (see photoinitiator)
nozzle	the small opening (in the inkjet print head from which the ink is ejected (typical piezo print heads comprise multiple nozzles, up to several thousands; nozzle diameter ranges from 10 to 50 µm)

Glossary

photoinitiator	a molecule that undergoes a photoreaction on absorption of light, producing reactive species; in the case of UV curing, the photoinitiator forms radicals upon absorption of UV light; the radicals will start the polymerization of the monomers
pigment	a colorant that is insoluble in the ink carrier fluid (in case of UV inkjet ink, the carrier is a monomer), forming discrete particles
pigment dispersion	homogeneous stable suspension of the pigment particles in the dispersion medium (monomer in case of a UV inkjet ink)
polymeric dispersant	polymer that acts as suspending agent for the pigment particles in the dispersion medium in order to have a stable homogeneous suspension and prevention of settling of the pigment particles
piezo printhead	inkjet print head based on piezo material, whereby jetted drops are obtained through the mechanical distortion of the piezo element induced by applying electrical charge
substrate	the material of which surface the drops are jetted onto
surface tension	force at the surface of a liquid to minimize the area of the surface; the lower the value, the better the ink wetting on the surface of a substrate
surfactant	surface-active compound lowering the surface tension of an ink
UV curing	photochemical process in which ultraviolet (UV) light is used to instantly cure inks using a combination of monomers and photoinitiators to form a solid polymeric layer of ink
viscosity	internal resistance to flow of the ink; the more viscous the ink is, the slower or more difficult it passes through pumps, pipes and filters; the inkjet piezo drop formation process typically requires an ink viscosity between 2 and 20 mPa.s at jetting temperature
wetting	the spreading of ink drops when jetted on a substrate

About Agfa Graphics

Whatever you did this morning, or wherever you are headed to tonight, you definitely have come across or will encounter newspapers, magazines, books, labels, packaging, vouchers, cabinet doors, floors, etc. that were printed using Agfa Graphics technology.

Headquartered in Mortsel (Belgium), Agfa Graphics offers integrated prepress and print solutions to the sign and display and industrial inkjet printing industry, the commercial, packaging and security printing industry, as well as the newspaper printing and publishing industry. We are market leader in most of these segments, with production and R&D sites on five continents and direct sales organizations in over 40 countries around the world.

AGFA

WE EMBODY PRINT

All prepress for this brochure was done using Agfa Graphics Apogee workflow software.
Energy Elite Eco thermal printing plates were imaged on an Avalon platesetter with CristalRaster III screening technology and processed in an Arkana smart processor.
This brochure was printed on a Komori H-UV press.

GB 2018 10

www.agfagraphics.com/inks