The Inkjet Training

TheIJT.com

Masterclass Hands-on Lab Course in Curing & Drying

Advanced Course

1. COURSE DETAILS

Date:	February 27 - March 01, 2019
Location:	at iPrint in Marly, Switzerland
Participation Fee:	EUR 1,850
Registration Deadline:	January 15, 2019
Masterclass Registration:	iprint.center/education

2. TWO-DAY PROGRAM

In this course, we cover all aspects of drying and curing methods for inkjet printing. We discuss IR and NIR drying, UV curing, Ebeam curing and Flash curing and also have a look at ink and substrate influence on the curing process, optimization of curing time and equipment cost.

3. ADMISSION REQUIREMENTS

The course is open to all participants who have:

- completed the foundation course in inkjet engineering and inkjet chemistry at the iPrint Institute and/or
- basic understanding of post-treatment

4. BACKGROUND

The most common type of inkjet inks are aqueous, solvent, radiation-curable, and hot melt. During printing, all these inks undergo a solid transformation from liquid to solid. It is a phase change for hot melt inks. For solvent and water based inks, the liquid content of the ink, the carrier fluid is removed by evaporation. Radiation curable inks polymerized when exposed to UV or a beam of electrons. For ceramic or conductive inks, sintering is done by flash curing or in an oven. UV inks and eBeam inks are part of the same family: radiation curing. In both case, an energy source starts a cross-linking polymerization of the reactive species that contained in the inks. Under UV light, photoinitiators present in UV inks will degrade and product free radicals start a cross-linking reaction by reacting with the monomers and oligomers. Most of the UV inks use a free radical polymerization mechanism (>95%). The selection of a photoinitiator depends principally of the UV source and the radiation absorption of the ink. Two types of UV sources coexist, mercury lamps with a broad spectrum and UV led that provide a nearly monochromatic emission (8-15nm FWHM). With mercury lamps, the photoinitiator receive both UVC that enable a good surface-cure, and UVA and UVB for through-cure. With UV led curing, normally in the UVA range, the photoinitiator absorbance will not lead to a good surface and through cure. A common solutionfor this is to use a photoinitiator blend, to permit a complete through cure. Photoinitiators typically represent 2-10% in weight of ink formulation. Surface cure remains an issue due to oxygen inhibition that inhibit the free radical formation, this is true especially for thin layer.

5. ADVANCED CURING/DRYING

Printing with UV inks allows to print on a wide range of substrates, with a good adhesion and scratch resistance. As curing is instantaneous high-speed or multi-layers printing are also possible. For UV ink, the dried layer thickness is equal to the cured layer thickness. For some application like packaging where flexibility is key, hybrid UV ink with a solvent have been developed to have a thinner ink layer.

Contrary to UV curing, electron beam is well suited to cure thick layers. Ebeam-curable inks and varnishes do not contain solvents and photoinitiators. When electrons penetrate matter, they collide with the electron cloud of every molecule, this leads to the production of excited moleculees such as ions or free radicals. Then, free radical polymerization or cross linking takes place. Electrons have enough energy to penetrate pigmented ink and coating. With Ebeam there is not post curing, the ink is 100% cured without monomer left. Contrary to UV curing, Ebeam curing does not generate heat, making it possible to cure ink on heat sensible substrate. Without photoinitiators, EB inks are cheaper than UV inks and less toxic. Electron beam curing is not so common due to the equipment and operating cost.

Photonic Curing is a thermal process in which substrates are heated with short pulses of light from a flash lamp with a broad spectrum of light. With pulse time of around 1ms, only the surface of the substrate gets warm while the substrate stays cool. With this process, it is possible to attain significantly higher temperatures without damaging the substrate than with an ordinary oven. Photonic curing is used to dry, sinter, or anneal inks on sensible substrate such as paper. It is perfect for printed electronics, where cheap and flexible substrates can be used instead of glass or ceramic substrates. In this case, the conductive traces absorb the light and get heat to several hundred degrees.

Heat can be used for evaporation, curing and sintering. Evaporation or drying is when the volatile contents of an ink are evaporated. Most of water based and solvent based inks are fixed on substrate by drying which leave only the pigments on the substrates and sintering that enhance the adhesion to the substrate. Heat can be transferred by radiation, conduction, and convection. In a convective drying oven, flows of hot air are used to dry substrates. The most important factor that defines the evaporation speed is the vapor pressure of the solvent, which increase with temperature. The flow is used not only for heat transfer but also to evacuate the solvent. Contrary to large convective oven, infrared and near infrared unit are used for drying in very compact units.

6. GILBERT GUGLER

The Masterclass will be led by Gilbert Gugler and representatives from equipment providers. Gilbert Gugler graduated in Material Science from ETH Zurich. He has over 25 years' experience in coating and process related topics. He is an expert in multilayer curtain coating technology and toll coating technologies, starting from preparation of coating fluids, characterization, to processing and drying.