Pigments and Dyes for Non-Impact Printing Applications

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Abstract

Non-Impact Color Printing can be seen everywhere: in the home, in the SOHO market (small office/home office), and in high-end industrial applications. Copiers, printers (laser/ink jet), and digital presses are available worldwide.

Responsible for the color in electrophotographic toners or in ink jet inks are either pigments or dyes.

Pigments are insoluble, so besides their chemical constitution (azo-, polycyclic-, phthalocyanine), various solid state parameters, like crystal structure, particle size and shape, and degree of crystallinity are also responsible for the properties.

Depending on such parameters, a pigment with a given chemical structure may or may not be suitable for Non-Impact Printing (NIP).Since pigments are described and listed according to the Colour Index number, one Colour Index number can easily cover several hundred commercial products with very different properties.

The Colour Index number is not enough to describe a pigment!

Dyes are soluble either in water or in organic solvents, and are derived from a great variety of different chemical classes. Here the chemical structure is mainly responsible for the coloristic properties.

However, for ink jet ink application, a variety of different demands has to be fulfilled in order to avoid problems like nozzle clogging, cogation, etc. One consequence of these demands is that in addition to existing traditional dyes (= Colour Index dyes), new Ink Jet dyes based on completely new chemistries are required.

This contribution will present state-of-the-art for pigments and dyes in non-impact printing applications, as well as upcoming new developments. The various chemical classes are explained. Technical aspects like coloristic and fastness properties, purity requirements for ink jet inks, and electrostatic charging influence in powder toner applications are discussed.

The presentation will focus on how pigments and dyes can be tailored for NIP applications. Selected examples will demonstrate aspects like pigment particle shape (e.g. cubic or needle), particle surface charge (e.g. cationic or anionic), and their correlation to the application properties.

Newer technologies like polymerisation toners or photorealistic ink jet and their influence on NIP-pigments and NIP-dyes are discussed.

In addition, the importance of chemical legislation and some of the most recent environmental and toxicological aspects of colorants will be covered.

References

1. H.-T. Macholdt, R. Baur, J. Geisenberger, H. Menzel, W. Zöller "Non-Impact Printing: Pigments, Dyes and Charge Control Agents" Ink Makers Forum, European Congress on Printing Inks, Nuremberg/Germany, April 5, 2001, proceedings pp. 193-211.
2. T. Moretti "Electrophotographic Toners and Ink Jet Inks: Raw Material Requirements", American Ink Maker, February 2000, pp 32-38.
3. Colour Index, The Society of Dyers and Colourists, Bradford, UK, 1997. The Colour Index (C.I.) lists and describes the different pigments and dyes in terms of running numbers, e.g. Pigment Yellow 180 = P.Y.180, Pigment Red 122 = P.R.122, Pigment Blue 15:3 = P.Bl.15:3. Typically one C.I. number covers a variety of different commercial products with different properties. For P.Bl. 15:3, the standard cyan pigment, approximately 280 different commercial types are listed, only a few are suitable for NIP.

Biography

Dr. Hans-Tobias Macholdt, Clariant GmbH Division Pigments and Additivies, is head of R&D Non Impact Printing, with 15 years experience in toner pigments, charge control agents and ink jet colorants. He received his PhD in Chemistry (1984) at Technical University Darmstadt, Germany. PhD Thesis on "Metal organic complex chemistry"; joint project with the German Cancer Research Center, Heidelberg. 1984/85 Postdoctoral fellowship at Leicester University, UK and Goethe University, Frankfurt/M. Numerous publications, and patents. Contribution to books: "Chemistry of Functional Dyes" vol 1 (MITA Press, Tokio 1989) and Vol 2 (MITA Press, Tokio 1993). Member of IS+T, GDCh (German Chemical Society), Institut of Electrostatics Japan.