Novel Colorants for Jet Inks Based on Dye-Packaging Technology

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Abstract

The emerging markets and evolving safety regulations for color ink jet printing have placed more rigorous and at times new and specific requirements on ink jet ink designs. A short list of these requirements may include: 1. Larger color gamut (clear color); 2. Archival prints with enhanced image quality; 3. Any substrate or media printing; 4. Rapid throughput (approaching engine limits); 5. All-safe properties.

Colorants available today do not enable the ink design chemists and engineers to meet existing market needs much less the requirements of emerging ink jet markets. This paper addresses the issues biased from a colorant design perspective. In addition, we provide an example of a dye-packaging technology (DPT) that addresses in-part these same topics.

Two major varieties of ink colorants are embodied in conventional ink jet ink systems. One is water- or alcohol-soluble dye based inks and the other is pigmented inks. Dye-based inks have clear color and high reliability, however they are suffering from inadequate water fastness and light fastness properties. Pigmented inks have advantages in both of the latter properties, but they have limitations based on complex dispersion designs, and clear color. The dye-packaging technology is one of the new approaches that can be used to minimize and in some cases, overcome these problems.

The bodacious design goal of DPT systems is to separate the color science issues from the printability issues. In so doing, color science design teams may meet market requirements without a dramatic impact on the print engine design. Similarly, the print engine design team is able to optimize for printability without dramatic impact on the color science. Through the separation of these two highly interactive design constraints, less technologically oriented OEM's are empowered to identify and develop new markets for all digital printing technologies. This is particularly viable for the needs of the emerging textile or decorative and applied fine arts markets. Dye packaging promises to provide vehicle blindness over a wide range of ink vehicles and also offers a type of dye receptor for optimal image formation on a wide variety of print media. As packaged dyes, the DPT materials depict color gamut's that are identical to the dyestuff that they are derived. Most importantly, the DPT materials permit the use of otherwise unsafe dyestuff such as Rhodamines thereby providing a kind of all-safe packaging of dyes. As particles, these pseudo-pigments provide holdout and other rheological properties that are similar to their pigment counter-parts. As free polymeric surfaces that may be modified, the DPT materials offer the potential to make systems that are sensitive to the media environment thereby providing a "pre-receptor" component to the colorant.

In this presentation, the two disadvantages of DPT materials relative to pigmented materials which include dye-loading and light fastness will be discussed. Both of these parameters are active areas of DPT research and will be greatly improved upon in the near future. We have developed new DPT colorants based on the stable suspension of cross-linked aminoformaldehyde resin having relatively uniform particle size, excellent solvent resistance and satisfactory light fastness in aqueous solutions. The DPT colorants containing conventional or fluorescent dyes encapsulated within spherical, solvent resistant, polymer particles having a mean particle size below 250 nm show excellent dispersion stability.

Also discussed will be the light fading stability of images made with DPT materials containing fluorescent dyes and images made with water solutions containing the same dyes. Results are quoted as color difference (ΔE) units in CIEL*a*b* color space. Four different DPT fluorescent colorants (yellow, orange, red and magenta) were studied. All investigated colorants are more photostable systems that corresponding dyes. Yellow and orange colorants have almost identical fading rates whereas the red is less stable and magenta is the least stable.

Biography

Nikolay N. Barashkov received his PhD and degree of Doctor of Science from Karpov Institute of Physical Chemistry (Moscow, Russia). He came to the US in 1993 and following research appointments at Fermi National Laboratory and Texas Tech University was Research Scientist with the University of Texas at Dallas. He joined Radiant Color in 1997, and his research interests include the chemical and photophysical aspects of polymer-fluorescent dyes interaction. E-mail: nbarashkov@ radiantcolor.com