Developments in high performance pigments

Dr. Abul Iqbal
IQChem, Basel, Switzerland

The global volume of pigment market is estimated to be 6.1million tons in which titanium dioxide is claiming to have 63.5% market share. Colour and special effect pigments are contributing 24.7% to the market whereas the rest is filled by carbon black and to a very lesser extend by zinc oxide. In the colour and special effect pigment market inorganic pigments is contributing 84.8% market share in which the iron oxide pigments are predominant and the rest is supported by organic colour and special effect pigments.

The organic colour and special effect pigments comprises of phthalocyanine blue and green (28.9%), azo (red) (24.15), diarylide yellows (23.9%), high performance special effect (15.2%) and other classic pigments (7.8%).

The organic pigment market comprises largely of printing inks (52%), paints and coatings (23%), plastic (13%), and other small areas such as textile printing, pigmented fibers, paper and others. The special effect pigments are light reflecting metallic aluminium flake, light refracting pearlescent, light interference colour shifting and light emitting luminescent pigments. The high performance pigments consist of phthalocyanine blues and greens, quinacridones, benzimidazolone, disazo condensation, perylene, DPP, isoindoline, quinophthalone, isoindolinone and indanthrone pigments.

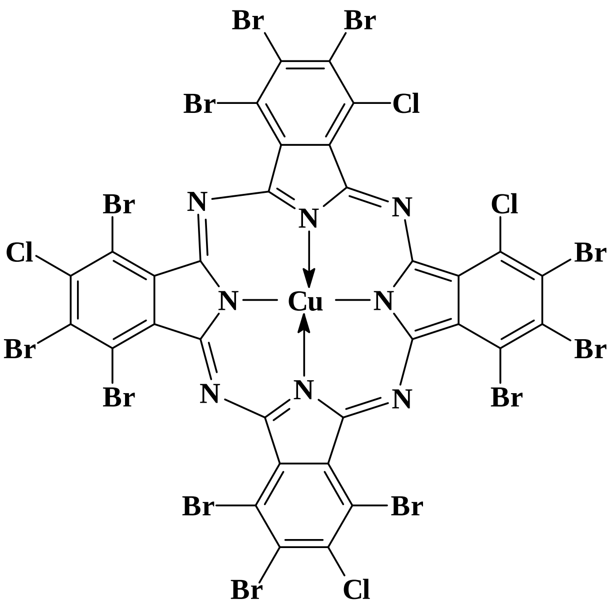
There are various definitions for high performance pigments. “A High Performance Pigment is one that demonstrates high performance properties in its intended end-use”. “A High Performance Pigment is one that commands a premium price based on value-in-use and which has not yet been copied by generic producers”. “A High Performance Pigment is one that is the right pigment or a specific use with well-defined quality criteria at optimized cost”. The drivers for the development of organic high performance pigments are Ecology, Energy and Economy, Esthetics, Engineering and Technology, Electronics & High Tech applications. The ecology trends are defined as Safe processes and products, ecological disposal of hazards, Energy conservation and conversion, Recycling and bio-degradibility of Products and substrates.

Organic high performance pigments are also used in high technology applications such as Displays, Optical Info Storage, Digital Imaging and Printing, Medicine and Energy.

The organic high performace pigments should satisfy a variety of criteria for the application in paints such as Zero VOC (high solids, water-borne, solvent- free, powder coating), Stirr-in dispersibility and dispersion stability, Good flow/rheology, High fastness level, Free-flowing, low-dusting, easy metering, Versatile, binder-free, high pigment loading and Pigment concentrates like liquid, paste, powder and tinter. The properties of organic pigments for the application in plastics include Heat Stability, High Duty Engineering Plastics Pigments, High-loading Mono-Pigment Concentrates (micro-pellets, universal, non-dusting, free-flowing, meterable) and masterbatches, Non-warping Pigments and Light-stable Daylight Fluorescent Colours.

Liquid crystal displays

There are various pigments that can be used in the colour filter of liquid crystal displays. These include Pigment Green 36 **1**, Pigment Red 254 **2**, Pigment yellow 138 **3**, Pigment Yellow 139 **4**, Pigment blue 15:6 **5** and Pigment Violet 23 **6**.



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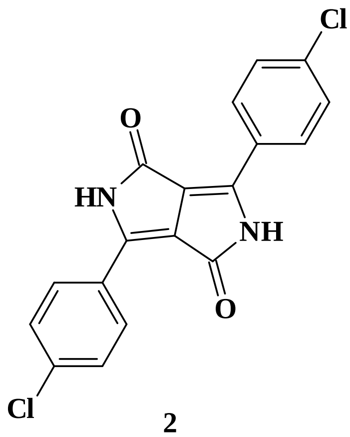

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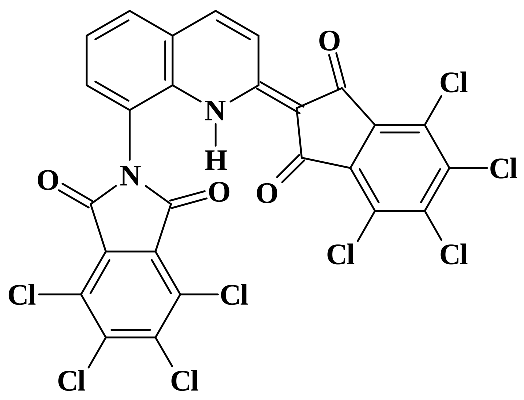

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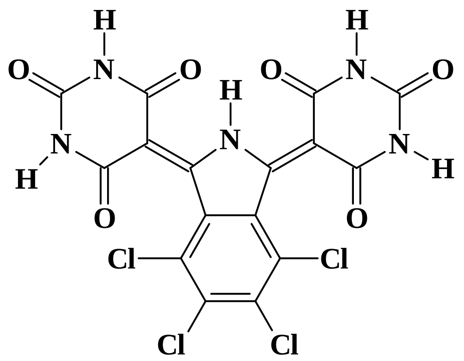

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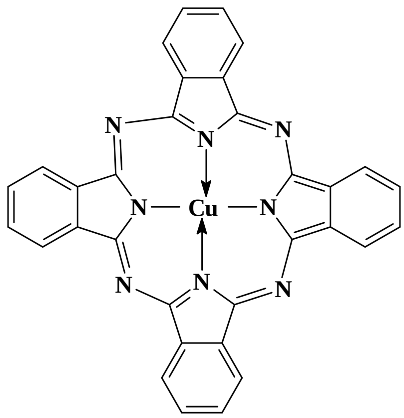

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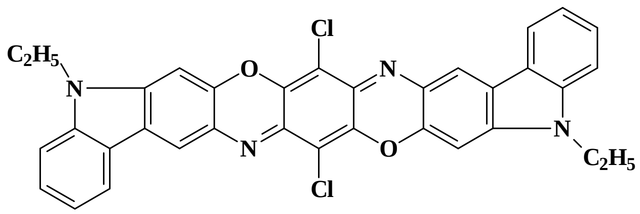

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Electrophotography

Digital revolution has led to tremendous increase in imaging and data recording system during the last few decades. This rapid development has to do with the fact that there is more than just one method available for different applications, depending on whether cost, speed and or quality are the decisive factors. **Figure 1** and **Figure 2** shows various charge generating pigments and charge transport layer pigments that is used in electrophotography.

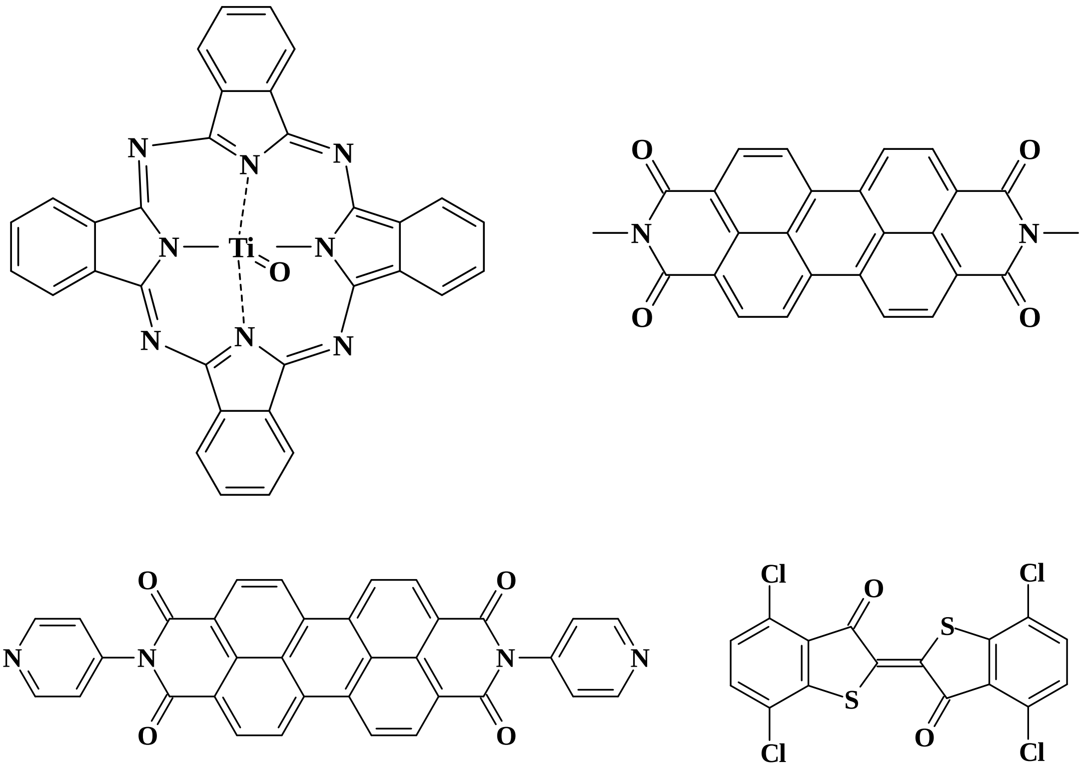


Figure 1: CGM Pigments

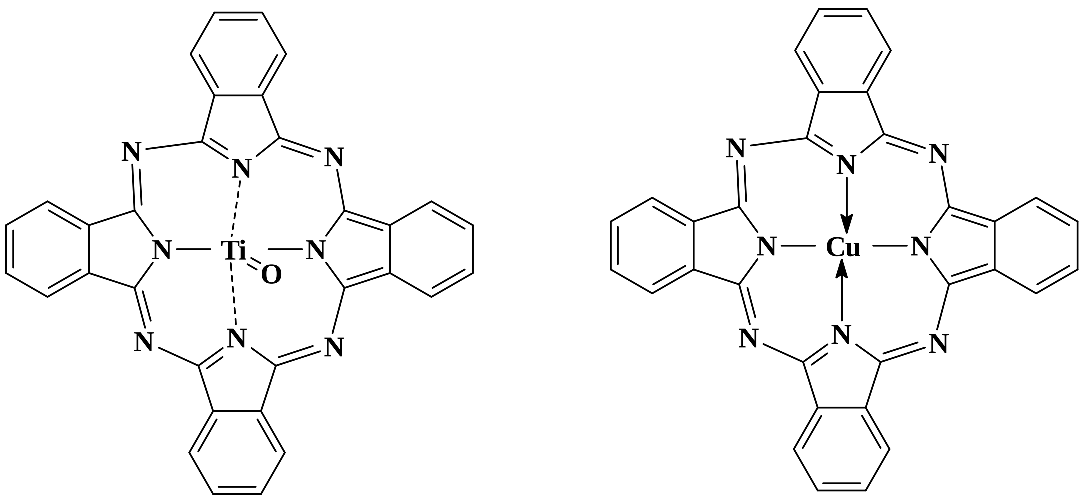
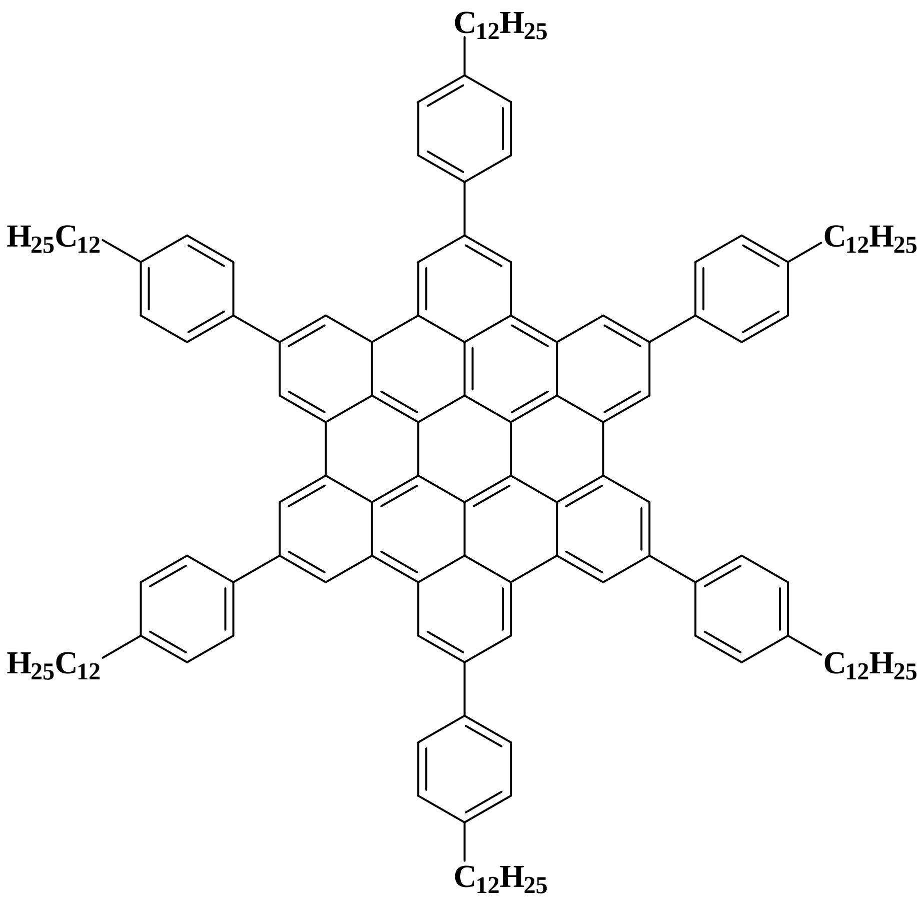


Figure 2: CTL hole transport pigments

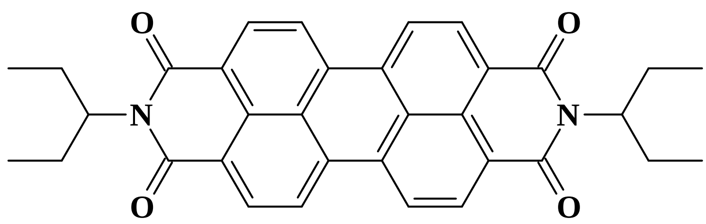
Pigments in Solar cells

The present world wide energy consumption amounts to 6 tetrawatts per year and is expected to grow rapidly in the next decades due to the increase in the demand from the developing countries. Ironically, the consumption is only 0.1% of the total solar energy taken up from the sun.

Photochemistry is expected to make important contributions to identify environmentally friendly solutions to the energy problems. One attractive strategy is the development of the systems that mimic natural photosynthesis in the conversion and storage of solar energy. Dye sensitised solar cells are the most promising alternative solar cells conceived in recent years. These unusual cells combine the aspects of semiconductor photo electrochemistry, dye sensitization and colloid chemistry to convert solar energy in a far efficient way. **Figure 3** Depicts the organic silicon cells currently used.



Hexabenzacoronene hole transport



Perylene electron transport

Figure 3: Organic silicon cells