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Book and Media Review

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Review of *Colour Chemistry*, 2nd Edition

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Colour Chemistry, 2nd ed., Robert M. Christie. Royal Society of Chemistry: Cambridge, UK, 2015. ISBN 978-1-84973-328-1 (soft cover) $64.

Color. Something ubiquitous, fascinating to all since an early age. Small children are enthralled by bright colors and love to learn with them. As we get older, our tastes change yet color is very much part of our lives. Some of us remember that one of the prime reasons we were attracted to chemistry (and still are) was color. This reviewer had a basement laboratory as a teenager and was fascinated by growing copper sulfate crystals and the varied colors of ferri- and ferrocyanides.

Pedagogically, students may first experience color in preschool and later in prism spectra and in art class. Color was the theme of Alan Alda's "What is flame" contest in 2014[1] and was the theme for NCW in 2015.[2] In chemistry, both pedagogically and in research, color is extensively involved especially in pH indicators and other features of reactions. A recent search of "color" anywhere in this *Journal* retrieved 8474 hits (filter applied). *Colour Chemistry*, 2nd ed., an excellent update of the first edition, can help in further instruction in the chemistry and technology of color and its ramification in dyes, pigments, and so on.

The first chapter, a historical perspective, describes the ubiquity of color in our lives, early dyes and pigments, the advent of synthetic dyes, 20th-century color chemistry, and future trends, including chemical structures.

Chapter 2 covers the physical and chemical basis of color. The causes and perception of color (i.e., visible light) are discussed in detail, including interaction of light with the eye and with objects, fluorescence and phosphorescence, dyes and pigments, and color due to molecular structure and inorganic compounds. Complementary color relationships, primary colors, and additive and subtractive color mixing are described in detail with color illustrations. Also described are the causes of color, UV and visible spectra. Fluorescence and phosphorescence are differentiated and described, as are dyes and pigments. The dependence of color on chemical structure via valence-bond and molecular orbital approaches is described in detail.

In this reviewer's undergraduate research, IR and UV−visible spectra played important roles in compound identification. The reviewer quickly learned the appearance of the complementary colors produced in response to the color of the wavelength of light as the UV absorption band crept into the visible with increasing wavelength and changing structure, first yellow, then orange, then red. He was surprised when one compound was greenish yellow, the complementary color to violet light, just as predicted (see the table on p 23).

These first two chapters are quite comprehensive for the topics covered but the remaining 10 chapters cover the chemistry, technology, and applications of color. Chemical structures and reaction schemes provide excellent illustration. Chapter 3 describes the colorants dyes and pigments. They are differentiated by solubility and uses (dyes are soluble, pigments are not). Azo dyes and pigments, comprising 60−70% of textile dyes, lead off the chapter. Isomerization and syntheses are discussed in detail, including diazotization, azo coupling, and synthetic strategies. The chapter concludes with descriptions of mono and multiple azo dyes and pigments as well as metal complex azo agents.

Chapter 4 covers carbonyl dyes and pigments, including anthraquinones, indigoids (especially indigo, both natural and synthetic), benzofuranones, fluorescents, and a broad spectrum of carbonyl pigments. The chapter concludes with synthetic schemes for the various classes of colorants. Chapter 5 describes the 20th-century discovery of phthalocyanines, including their structure−property relationships and syntheses. Miscellaneous classes of colorants are described in Chapter 6, including polyenes, carbonium ions, and nitro colorants.

Chapters 7 and 8 cover textile dyes for protein, cellulosic, and synthetic fibers. Chapter 9 describes pigments, organic, inorganic, molecular modeling, and special effects. Chapter 10, new for this second edition, covers coloring in cosmetics, especially hair coloring.

"High technology" aspects are covered in Chapter 11, including electronic applications (LEDs, etc.), laser dyes, solar energy conversion, optical data storage, reprographics and electrophotography, biomedical applications (stains, probes, therapies), thermochromism, and photochromism.

Environmental issues are covered in Chapter 12, including manufacture, introduction into the environment, toxicity and other hazards, legislation, and regulation (including European REACH policies).[3]

The entire book is well illustrated with chemical structures and reaction schemes. Each chapter concludes with a list of references, and the book concludes with an index. *Colour Chemistry*, 2nd ed. is recommended for students and technologists with an adequate background in chemistry who are interested in the fundamentals and applications of color. It could also act as a resource for classes such as Chemistry for Poets or Artists.

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Notes

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