

Preface

Phthalocyanines, since their accidental discovery in 1928, have established themselves as industrial commodities, especially as blue and green pigments of incomparable excellence. Nowadays, they enjoy a variety of industrial and medical applications as well as their use as colorants, where optical absorption and/or emission phenomena by the macrocyclic dyestuffs underlie the mechanisms.

A considerable number of scientists, engineers, and students may have been involved in work with phthalocyanines. During the course of their study, they may have tried to characterize their compounds, which can be either novel or known, or to monitor their reactions by means of optical spectroscopy. Some unfortunate investigators must have seen spectra quite different from prototypical ones that are displayed in textbooks. These compounds are tricky because they can be involved in colorful chemistry including molecular aggregation, electron transfer, and acid–base equilibria. They are prone to aggregation at a higher concentration, which gives rise to drastic spectral changes. Meanwhile, at a lower concentration, some portion can be consumed to produce another species (which could be protonated, oxidized, reduced, demetalated, or degraded) through a reaction (or reactions) with a trace amount of impurities in the solvents used for the spectral measurement. This is because their molar extinction coefficients are very large (on the order of $10^5 \text{ M}^{-1} \text{ cm}^{-1}$), so measurements have to be taken at a very low concentration around 10^{-6} M . This implies that reproducibility of spectral measurements might be poor unless their concentrations are accurately controlled. Thus, spectra of phthalocyanines behave like the sea god Proteus under various conditions and hence sometimes can be very misleading. Therefore, some novice investigators (including the author himself in his youth) may have been embarrassed by the deceptive behavior of phthalocyanines and could have, in the worst cases, given up their research.

This book is aimed not merely at reviewing the optical spectra of phthalocyanines and related compounds, but also at helping such people, particularly beginners, to understand the optical spectra of those macrocyclic dyes by showing some examples of their prototypical spectra and their variations in several situations. For the purpose of deepening the understanding of spectra of the macrocyclic

compounds, the book also provides an introduction to a theoretical background of their spectra as graphically as possible and without mathematization for readers who are weak in mathematics just like the author himself.

It is hoped that this book will be of help to such phthalocyanine beginners who are exhausted by the mischief of the macrocyclic witches.

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Compounds

A Guide for Beginners

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