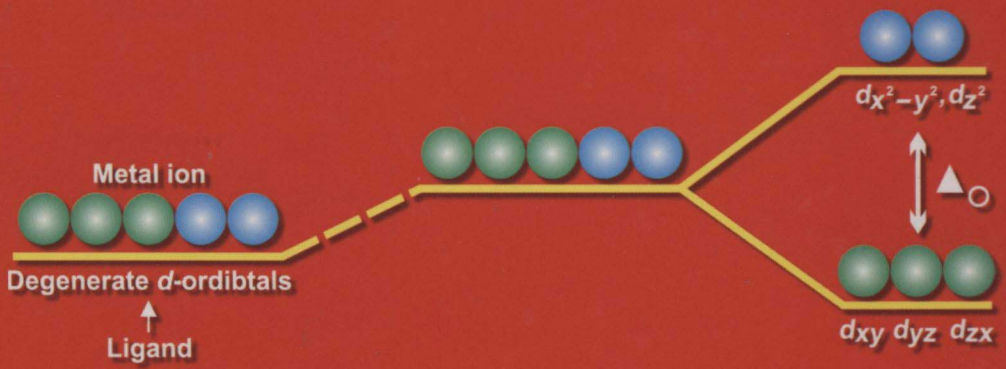
Coordination Chemistry

Metal Complexes
Transition Metal Chemistry
with Lanthanides and Actinides



CRC Press
Taylor & Francis Group

P.L. Soni
Vandna Soni

Coordination Chemistry

Metal Complexes
Transition Metal Chemistry
with Lanthanides and Actinides

[A Textbook for Graduate and Post Graduate Students of All Indian, Asian and Foreign Universities]

Dr. P.L. Soni

Formerly Associate Professor in Chemistry,
ARSD College,
University of Delhi

&

Dr. Vandna Soni

Assistant Professor in Chemistry
Maharaja Agrasen College,
University of Delhi

CRC Taylor & Francis
Taylor & Francis Group
Boca Raton London New York

CRC is an imprint of the Taylor & Francis Group, an informa business

Ane Books Pvt. Ltd.

Coordination Chemistry

P.L. Soni and Vandna Soni

Published by

Ane Books Pvt. Ltd.

4821 Parwana Bhawan, 1st Floor
24 Ansari Road, Darya Ganj, New Delhi - 110 002, India
Tel: +91 (011) 2327 6843-44, 2324 6385
Fax: +91 (011) 2327 6863
e-mail: anebooks@vsnl.net
Website: www.anebooks.com

For

CRC Press

Taylor & Francis Group
6000 Broken Sound Parkway, NW, Suite 300
Boca Raton, FL 33487 U.S.A.
Tel : 561 998 2541
Fax : 561 997 7249 or 561 998 2559
Web : www.taylorandfrancis.com

For distribution in rest of the world other than the Indian sub-continent

ISBN : 978-1466-500-501

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

Printed at: Gopsons Papers Ltd., Noida

Coordination Chemistry

Metal Complexes
Transition Metal Chemistry
with Lanthanides and Actinides

Dedicated to

My late parents
Diwan Hari Charan Das Soni

and

Shakuntla Devi
who were an inspiring force and always stood
by me in weaker moments of my life.
Their Aashirwads from heavens are a guiding force.

Preface

Eversince, I joined the teaching profession way back in 1966 in SD College (Lahore) Ambala Cantt., I was obsessed with desire to write the book on the subject of chemistry. I joined ARSD college university of Delhi in 1968 to teach chemistry to B.Sc. (Gen.) course. In the year 1971 B. Sc. (Hons.) Chemistry got transferred to the colleges of Delhi University and some challenge, depth and seriousness flowed in the teaching of chemistry.

In the last 25 years in ARSD College I had the privilege to teach coordination chemistry to B. Sc. (Gen.) and B.Sc. (Hons.) classes, this gave me an opportunity to the have close contact with the subject and try to understand its intricacies and nuances. I feel certain amount of maturity and experience is a must before one ventures to enter the arena of book writing.

Besides, writing the facts and theories in a systematic and lucid style it is imperative that author must put something of his own in the book. Only then life can be infused into the book, otherwise the book would be like any other book in the market. The author has tried to put his knowledge, understanding and experience into the book. I am sure readers will experience a new approach to the understanding of coordination chemistry in which all the interesting aspects of the metal complexes have been probed and highlighted.

Knowledge of complexes was given by Wisner in the year 1913. This book dwells extensively on all the aspects of metal complexes in a simple and lucid style. Metal complexes find applications in the field of Medicine, Pharmacy, Polymer Chemistry and Agriculture etc. The very existence of life in all possible forms is a gift of coordination chemistry. Polymers are considered the index symbol of progress of any country, coordination chemistry plays a key role in polymers. Blood that flows in the veins of animals and humans, chlorophyll in plants is a charisma of coordination chemists. Last of all, I feel the readers will enjoy, appreciate and draw benefit from my vast experience in the subject, the sequence of topics, theories covered, unfolding their intricacies systematically. Valuable suggestions are invited from the readers so as to enrich the contents of the book from time to time. My grateful thanks to my wife Kamini Soni,

Principal Navyug School, Sarojini Nagar, New Delhi who had been an inspiring invisible force, quietly encouraging me day to day in my endeavour to put my ideas and views before the vast community of readers.

My co-author Dr. Vandna Soni, Assistant Professor in Chemistry, Maharaja Agarsen College, Delhi University has given a useful contribution in systematising the facts and theories in the book in the present form.

The book has been published in two parts. Part one deals with nomenclature, stereo chemistry and the different theories regarding the bonding in complexes. It includes metal carbonyls and nitrosyls, a select topic in complexes. The π-bonding carbonyls and nitrosyls show two way bonding (band bonding). Another select topic of organometallics also finds a place in this volume.

Part two deals with transition metal chemistry. A group-wise study of elements in $3d$, $4d$ and $5d$ transition series has been discussed with emphasis on complexes and organometallics. Besides this inner tranisition elements chemistry has been taken up at length (Lanthanides and Actinides).

Lastly, I whole heartedly thank and praise the contribution of my Publisher Sh. Sunil Saxena, Sh. J.R. Kapoor for the untiring effort of their team, out of which Vivek Ratan and Nishant Saini need a special mention.

Dr. P.L. Soni

Contents

PART I

Coordination Chemistry
(Metal Complexes)

PART II

Coordination Chemistry
(Transition Metal Chemistry)

PART–I

COORDINATION CHEMISTRY

- (Metal Complexes)
- (Select Topics)
- Organometallics