TAILORED METAL CATALYSTS

CATALYSIS BY METAL COMPLEXES

TAILORED METAL CATALYSTS

Edited by

YASUHIRO IWASAWA
Department of Chemistry, Faculty of Science,
The University of Tokyo, Japan

D. REIDEL PUBLISHING COMPANY

A MEMBER OF THE KLUWER  ACADEMIC PUBLISHERS GROUP

DORDRECHT / BOSTON / LANCASTER / TOKYO

Library of Congress Cataloging-in-Publication Data

CIP

Main entry under title:

Tailored metal catalysts.

(Catalysis by metal complexes)
Includes bibliographies and index.
1. Metal catalysts. I. Iwasawa, Yasuhiro, 1946 – II. Series.
QD505.T33 1986 541.3'95 85-28324
ISBN-13: 978-94-010-8823-7 e-ISBN-13: 978-94-009-5261-4
DOI: 10.1007/978-94-009-5261-4

Published by D. Reidel Publishing Company,
P.O. Box 17, 3300 AA Dordrecht, Holland.

Sold and distributed in the U.S.A. and Canada
by Kluwer Academic Publishers
190 Old Derby Street, Hingham, MA 02043, U.S.A.

In all other countries, sold and distributed
by Kluwer Academic Publishers Group,
P.O. Box 322, 3300 AH Dordrecht, Holland.

TABLE OF CONTENTS

PREFACE

Well tailored metal catalysts are catalysts of the new generation resulting from scientific development at the boundary between homogeneous and heterogeneous chemistry. The main factors involved in making tailored metal catalysts are not those of traditional impregnation in which the chemistry is in general unknown and ill-defined, or of simple ion exchange which involves long-range forces with little control on the local structure through definite and special bond direction.

Tailored Metal Catalysts thus has a rather different emphasis from normal review publications in the field of catalysis. Here we concentrate more on the distinct surface chemistry and catalytic properties of important established materials with well-characterized active structures or precursors, although at the same time providing a systematic presentation of relevant data.

Many pioneering works have been undertaken in the field of tailored metal catalysts since the early research on polymer-attached homogeneous metal complexes by the British Petroleum Company Ltd. and the Mobil Oil Corporation around 1969; transition metal complexes attached on polymers by Grubbs (1971), Heinemann (1971), Manassen (1971), Pittman (1971), Bursian *et al.* (1972), Kagan (1973), Bailar (1974); transition metal complexes attached on inorganic oxides by Allum *et al.* (1972), Ballard (1973), Candlin and Thomas (1974), Murrell (1974), Yermakov (1974); metal carbonyls/polymers by Moffat (1970); metal carbonyls/inorganic oxides by Parkyns (1965), Davie *et al.* (1969), Banks *et al.* (1969), Howe (1973), Burwell (1975); metal carbonyl clusters/polymers by Collman (1972); metal carbonyl clusters/inorganic oxides by Robertson and Webb (1974), Anderson (1974), Smith *et al.* (1975).

In the middle and late 1970s the concept of attached catalysts was developed and various types of examples were described in the literature. An important subject in the 1980's and the future may be the tailoring of novel surface compounds which have no direct homogeneous analogs. Surface tailoring has strategic advantages in the synthesis of catalysts with surface structures and compositions which are unusual in homogeneous systems and acutely difficult to make in traditional heterogeneous systems. Tailored metal catalysts may contribute to a complete understanding of the origin of heterogeneous catalysis

and to elegant improvements in solid catalysts. I believe that *Tailored Metal Catalysts* can provide a valuable contribution toward present and future fundamental and practical catalyst research.

We appreciate the assistance of Dr. Howe, one of the authors, for the correction of the English in this book. We also grateful to the various authors and editors who kindly gave us permission to reproduce diagrams from their papers.

Yasuhiro Iwasawa

The University of Tokyo,
Tokyo, Japan

April 1984