HANDBOOK OF HETEROGENEOUS CATALYTIC HYDROGENATION FOR ORGANIC SYNTHESIS

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A Wiley-Interscience Publication

JOHN WILEY & SONS, INC.

New York • Chichester • Weinheim • Brisbane • Singapore • Toronto

This book is printed on acid-free paper. ♾

Published simultaneously in Canada.

Library of Congress Cataloging in Publication Data:

Nishimura, Shigeo
Handbook of heterogeneous catalytic hydrogenation for organic synthesis / Shigeo Nishimura.
p. cm.
Includes bibliographical references and indexes.
ISBN 0-471-39698-2 (cloth : alk. paper)
1. Hydrogenation. 2. Catalysis. 3. Organic compounds—Synthesis. I. Title.

QD281.H8 N57 2001
547'.23—dc21 00-043746

Printed in the United States of America.

10 9 8 7 6 5 4 3 2 1

CONTENTS

PREFACE

Catalytic hydrogenation is undoubtedly the most useful and widely applicable method for the reduction of chemical substances, and has found numerous applications in organic synthesis in research laboratories and industrial processes. Almost all catalytic hydrogenations have been accomplished using heterogeneous catalysts since the earliest stages. Homogeneous catalysts have been further developed and have extended the scope of catalytic hydrogenation, in particular, for highly selective transformations. However, heterogeneous catalysts today continue to have many advantages over homogeneous catalysts, such as in the stability of catalyst, ease of separation of product from catalyst, a wide range of applicable reaction conditions, and high catalytic ability for the hydrogenation of hard-to-reduce functional groups such as aromatic nuclei and sterically hindered unsaturations and for the hydrogenolyses of carbon–carbon bonds. Also, many examples are included here where highly selective hydrogenations have been achieved over heterogeneous catalysts, typically in collaboration with effective additives, acids and bases, and solvents.

Examples of the hydrogenation of various functional groups and reaction pathways are illustrated in numerous equations and schemes in order to help the reader easily understand the reactions. In general, the reactions labeled as equations are described with experimental details to enable the user to choose a pertinent catalyst in a proper ratio to the substrate, a suitable solvent, and suitable reaction conditions for hydrogenation to be completed within a reasonable time. The reactions labeled as schemes will be helpful for better understanding reaction pathways as well as the selectivity of catalysts, although the difference between equations and schemes is not strict. Simple reactions are sometimes described in equations without experimental details. Comparable data are included in more than 100 tables, and will help the user understand the effects of various factors on the rate and/or selectivity, including the structure of compounds, the nature of catalysts and supports, and the nature of solvents and additives. A considerable number of experimental results not yet published by the author and coworkers can be found in this Handbook.

This book is intended primarily to provide experimental guidelines for organic syntheses. However, in fundamental hydrogenations, mechanistic aspects (to a limited extent) are also included. The hydrogenations of industrial importance have been described with adequate experimental and mechanistic details.

The references quoted here are by no means comprehensive. In general, those that seem to be related to basic or selective hydrogenations have been selected.

I am grateful to the authors of many excellent books to which I have referred during preparation of this book. These books are listed at the end of chapters under "General Bibliography."

I wish to express my thanks to the libraries and staff of The Institute of Physical and Chemical Research, Wako, Saitama and of Tokyo University of Pharmacy and Life Science, Hachioji, Tokyo. I acknowledge John Wiley and Sons, Inc. and their editorial staff for their cordial guidance and assistance in publishing this book. I thank Professor Emeritus Michio Shiota of Ochanomizu University and Professor Yuzuru Takagi of Nihon University for their helpful discussions. Special thanks are due to my three children who provided me with a new model personal computer with a TFT-LC display for preparing the manuscript and to my wife Yasuko, who had continuously encouraged and supported me in preparing and publishing this book until her death on November 28, 1999.

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