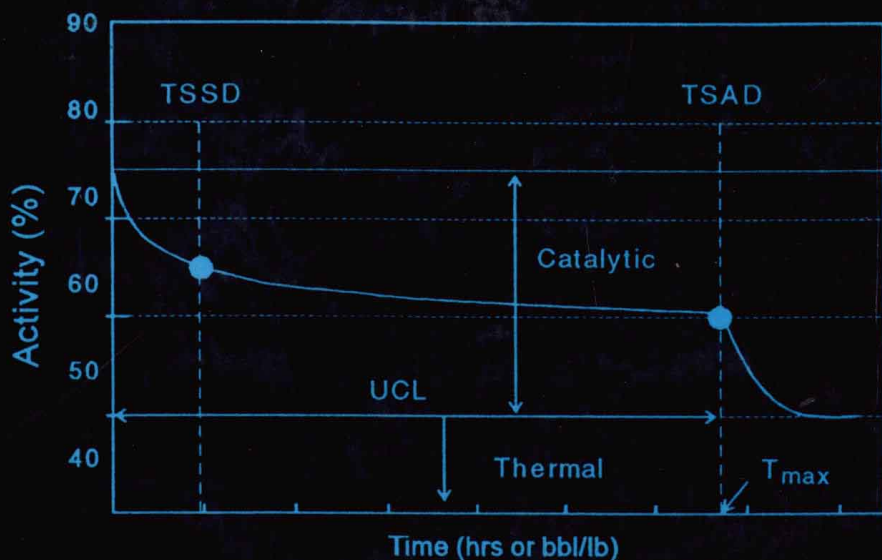


CATALYTIC HYDROPROCESSING OF PETROLEUM AND DISTILLATES



edited by
Michael C. Oballa
Stuart S. Shih

CATALYTIC HYDROPROCESSING OF PETROLEUM AND DISTILLATES

Based on the
Proceedings of the
AIChE Spring National Meeting,
Houston, Texas

March 28 - April 1, 1983

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**CATALYTIC
HYDROPROCESSING
OF PETROLEUM
AND DISTILLATES**

Preface

The era of refineries that process only light oils is almost over. There is a strong push for the processing of heavy oils, bitumen and/or residue, which in commercial jargon are combined and termed "bottom-of-the-barrel." The processing of "bottom-of-the-barrel" carries with it some problems. These are connected with obtaining state-of-the-art technologies at reasonable capital and operating costs to the refiner. Then there are problems associated with choosing the best catalyst—one specially designed to lower considerably the high content of heteroatoms (S, N, O) and metals (V, Ni, Fe) in the "bottom-of-the-barrel." The effective life of such catalysts becomes a factor to be reckoned with, especially when the economics of the various processes is being looked at. Recent regulations on the content of aromatics and sulfur in diesel fuels, as well as environmental concerns on SO_x and NO_x emissions from mobile and stationary combustion facilities, have made it imperative for engineers and scientists to think of ways to economically process middle distillates to meet new product specifications or more stringent emission regulations.

To address the above consideration, we organized a symposium at the AIChE Spring National Meeting in Houston, March 28–April 1, 1993. Engineers and scientists working in the processing of petroleum and distillates from different parts of the world presented papers covering different facets of residue upgrading and distillate hydrotreating. We thank the Fuels and Petrochemicals Division of the American Institute of Chemical Engineers for sponsoring this symposium. This book is a compilation of most of the papers presented in the five sessions of the symposium. We have broadly classified the papers in terms of content into the following four categories:

- a) Catalyst Deactivation
- b) Upgrading of Heavy Oils and Residue
- c) Hydrotreating of Distillates
- d) General Papers

We would like to thank all the people who contributed to make the publication of this book possible, including the authors, speakers and various organizations

that provided the necessary support. We give special thanks to the authors for preparing the manuscripts in the requested form and of such high quality that little editorial work was necessary.

We also express our appreciation to Professor Carle H. Bartholomew, who, as an invited guest speaker at the symposium, agreed to prepare a review paper on Catalyst Deactivation for this publication. Finally, the secretarial help of Ms. Karen Armellino and Ms. Kerri Dauphinee of Novacor Research & Technology Corporation is gratefully acknowledged.

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1 Catalyst Deactivation in Hydrotreating of Residua: A Review

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INTRODUCTION

Hydrotreating, the catalytic conversion and removal of organic sulfur, nitrogen, oxygen and metals from petroleum crudes at high hydrogen pressures and accompanied by hydrogenation of unsaturates and cracking of petroleum feedstocks to lower molecular hydrocarbons plays an ever increasing key role in the refinery. Indeed, hydrotreating capacity has been growing steadily (at about 6% per year since 1976) and represents today nearly 50% of the total refining capacity (1). The increased application of hydrotreating can be ascribed to (i) the ever decreasing availability of light, sweet crudes and thus the increasing fraction of heavy, sour crudes that must be processed and (ii) the trend to increase upgrading of feedstocks for improvement of downstream processing such as catalytic reforming and catalytic cracking.