Preface

Nanotechnology in desulfurization is a fascinating subject of recent origin. The expansion of nanomaterials is the focal point of research and technology that is mostly related to chemistry, physics, applied sciences, petroleum, and engineering. Research on nanotechnology has mainly focused on the aspects of synthesis of nanomaterials that have unique chemical, thermal and mechanical properties applicable for a wide range of applications. A variety of properties and phenomena has been investigated, and many of the studies have been directed toward understanding the properties and applications of nanomaterials.

Due to their enhanced chemical and mechanical properties, the nanomaterials play promising roles in enhancing the desulfurization. Nanomaterials have properties that are useful for enhancing surface-to-volume ratio, reactivity, strength, and durability. In pursuit of the same goal, this book offers detailed, up-to-date chapters on the synthesis, properties and technological developments of nanomaterials, and their applications in petroleum.

The first chapter of the book encompasses the occurrence of organosulfur compounds in petroleum and various techniques for the removal of these compounds. The next two chapters encompass the nanocomposites, hybrid materials and carbon-based nanomaterials for adsorptive desulfurization including preparation and evaluation.

The fourth chapter discussed the polyoxometalates as efficient catalysts for the activation of oxidants in desulfurization processes with the main goal to design heterogeneous polyoxometalate based catalysts. This chapter pretends to inform the research society about the scientific directions that have been taken using heterogeneous polyoxometalate catalysts in oxidative desulfurization of simulated and real liquid fuels. In Chapter 5, the relation of catalytic properties with components and structures of Ni/ZnO sorbent is discussed. Based on detailed characterization and reaction results, the dynamic change of Ni/ZnO sorbents during RADS is highlighted, the mechanisms of desulfurization, and the sulfur transfer and sulfur adsorption, etc.

In the next chapter, several scientific and technological advances reported in the literature for the desulfurization of fuels are reviewed and discussed. Amongst these techniques are oxidative desulfurization (ODS) and adsorptive desulfurization (ADS) which are proposed as additional steps to complement HDS in meeting the mandated ultra-low sulfur levels (10 ppmS).

Advances in the reduction of the costs inherent to fossil fuels' biodesulfurization towards its potential industrial applications are discussed in chapter seven. In the next chapter, environmental concerns and the importance of desulfurization is discussed.

In this book, we have tried to cover many aspects of nanomaterials for desulfurization, which is of current interest. This book is written for a large readership, including university students and researchers from diverse backgrounds such as chemistry, petroleum, materials science, physics, and engineering. It can be used not only as a textbook for both undergraduate and graduate students but also as a review and reference book for researchers in these fields. We hope that the chapters of this book will provide the readers with valuable insight into state-of-the-art advanced and functional nanomaterials and technologies.

However, it is possible that some topics have been left out owing to constraints on the size of the book and possible errors in judgment. We trust that the preface will be useful to students, teachers, and researchers.

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