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Preface

This special issue of Catalysis Today is primarily devoted to the various methods of sulfur removal to produce ultra clean fuels to meet new environmental standards. Nearly sulfur free gasoline and diesel fuel is being mandated by legislation in many countries with the amount of sulfur allowable in gasoline and diesel fuel being reduced to about <50 ppm currently and probably to <10 ppm by 2010. It has been found that sulfur compounds are a major contributor to smog due to their interaction with nitrogen oxides and also to reduction in the efficiency of autocatalytic converters. Autocatalytic converters cannot be used on board a vehicle to reduce the negative impact of sulfur compounds due to the inherent chemistry of the sulfur compounds, i.e. oxidation of sulfur compounds will produce sulfur oxides, while reduction of sulfur compounds will produce H_2S and or the yellow elemental sulfur which will either deposit on the catalytic converter, tail pipe or on the road to leave a yellow trail! Ultra clean fuel is also required to provide a hydrogen source for fuel cells since electrocatalysts such as Pt or Ni used in the current polymer electrolyte membrane fuel cell or solid oxide fuel cell are readily poisoned by S compounds. Therefore, currently there is a lot of interest in the production of essentially sulfur free gasoline and diesel fuel, as well as fuels that potentially could be used to provide hydrogen for fuel cells.

The major challenge to produce ultra low sulfur diesel fuel is to remove the refractory dibenzothiophenic compounds containing alkyl substituents in the 4,6 positions. These substituted dibenzothiophenic compounds are refractory since the alkly substituents hinder the direct interaction of the S with the active sites of the conventional hydrodesulfurization (HDS) catalysts such as supported CoMo or NiMo catalysts. In order to achieve ultra low sulfur content, higher temperature and pressure are required to desulfurize the refractory sulfur compounds. However, higher temperature and pressure processes are more costly and will also result in a higher hydrogen consumption and a higher degree of hydrogenation. In the case of gasoline, hydrogenation of the alkenes or aromatics will actually lower the octane number and the quality of the fuel.

The papers presented in this special issue on Sulfur Removal cover both the oral and poster presentations made at the 19th North American Catalysis Society meeting held in Philadelphia, Pennsylvania, USA on 22–27 May 2005. There were a total of 21 oral presentations and 25 poster presentations, including three invited key note speakers, Dr. R. Prins, Dr. R. Van Veen and Dr. R. Yang. The Session lasted one and half days. The topics presented in the Sulfur Removal Session include preparation and characterization of new HDS catalysts and the activity of these catalysts for the HDS of refractory sulfur compounds such as 4,6-dimethyldibenzothiophene. Besides HDS, there are quite a few papers on other approaches such as selective adsorption and oxidation. A review article on various approaches on HDS illustrates that there are still challenges to remove the refractory sulfur compounds and there is no one easy solution to achieve this objective. In particular, nitrogen-containing compounds have a strong inhibiting effect on the removal of refractory sulfur compounds due to competitive adsorption. Hence, there are still opportunities to find new approaches and innovative solutions for deep desulfurization including new catalysts and sorbents. Regardless of what pathway one chooses to work on, it must be realized that gasoline and diesel contains a variety of compounds which could compete with the sulfur compounds via competitive adsorption or could be more reactive towards a particular reagent used for sulfur removal. For example, clearly the effect of nitrogen and aromatic compounds will have a major impact on the success of any new process development on selective sulfur removal from diesel fuel.

I would like to thank the contributors and the reviewers for this Special Issue on Sulfur Removal. In particular I wish to thank Dr. R.J. Farrauto for the invitation to Chair the Session on Sulfur Removal at the 19th North American Catalysis Society meeting. I also wish to acknowledge Dr. J.J. Spivey for the invitation to be the Guest Editor for this Special Issue on Sulfur Removal for Catalysis Today and for his guidance in the preparation of this Special Issue on Sulfur removal.

Guest Editor
Flora T.T. Ng*
Department of Chemical Engineering,
University of Waterloo,
Waterloo, Ont., Canada, N2L 3G1

*Tel.: +1 519 888 4567; fax: +1 519 746 4979
E-mail address: fttng@email.uwaterloo.ca

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