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Preface

This special issue contains peer-reviewed manuscripts presented at the Symposium on Utilization of Greenhouse Gases, the 227th National Meeting of American Chemical Society, Anaheim, 27 March–1 April 2004. The guest editors are grateful to Divisions of Fuel Chemistry and Geo-chemistry of ACS for their sponsorship. This symposium continues the tradition of excellence of the previous symposium in Orlando (April, 2002) during the 223rd National Meeting of ACS.

This special issue focuses on the utilization of two major greenhouse gases, methane and carbon dioxide, that represents two major challenges to chemists and engineers worldwide. Methane is the most destructive greenhouse gas. It is also the major component of natural gas, coalmine gas, biogas and others. It is becoming a best alternative to petroleum in this new century. Carbon dioxide is the highest impact man-made greenhouse gas. Its emission has attained a serious concern worldwide with increasing evidence of global warming. Different from other mitigation technologies, the utilization considers carbon dioxide as a carbon feedstock or as a clean media for chemical syntheses. As addressed in the review made by Prof. Michele Aresta, mankind has been very successful in the use of carbon dioxide for syntheses of some chemicals. However, the present chemical production using carbon dioxide as feedstock only consumes a very small amount of carbon dioxide. Various utilization technologies are being developed worldwide in order to seek technically and economically feasible methods to convert carbon dioxide into valued chemicals. This special issue presents recent progress of these technologies. Typically, we have observed significant progress in the development of a novel catalyst for CO_2/Epoxide co-polymerization, reported by Prof. Donald J. Darensbourg, and in the development of a novel tri-reforming process, reported by Prof. Chunshan Song. Other improvements in catalyst design and preparation are also leading to development of practical CO_2 utilization technologies.

This special issue also presents reports on mimics of nature (biomimetics). Especially, an in situ fixation of carbon dioxide was presented for astaxanthin production using a mixed culture of *Haematococcus pluvialis* and *Phaffia rhodozyma*. CO_2 from *P. rhodozyme* fermentation can be fixed by *H. pluvialis*, while oxygen generated by *H. pluvialis* stimulates astaxanthin formation by *P. rhodozyma*. Since the microbial fermentation represents a significant contribution to CO_2 emission, the exploitation of in situ carbon dioxide fixation together with the improvement in the production of useful bio-products should be encouraged.

The second part of this special issue presents the newest progress in the investigation on methane conversion. Considering reactor engineering, Prof. Götz Veser and Dr. Yong Wang reported their achievements in the improvement of catalysts with great potential for small-scale conversion of methane. And, the combined reforming of methane may become a useful operation for methane valorization. In addition to the report on tri-reforming by Prof. Chunshan Song, several other groups are also making progress in combined reforming with partial oxidation of methane. Presentations on improvements in catalyst design and preparation have been made for partial oxidation, CO_2 reforming, steam reforming and oxidative coupling of methane. Novel catalyst preparations and innovative methane activation technologies continue to attract a lot of attention. This special issue includes three reports on plasma activation and one report on bromine activation, that represent the recent progress in activation of methane molecule using plasmas and/or using ''strong'' chemicals. Recent investigations also show that the plasma preparation of catalysts can lead to better production of catalysts for methane conversion with low energy input. Highly dispersed catalysts can be obtained with enhanced low temperature activity and improved stability for methane conversion for effective and efficient operation.

Finally, we acknowledge all the authors for their contributions. We also owe special appreciation to all of the referees. It is their careful review of the creative work that makes this quality issue possible.

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