Catalytic Conversion and Use of Carbon Dioxide (Editorial)

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The growing atmospheric concentration of carbon dioxide (CO_2) caused by human activities continues to be one of the major future challenges to resolve in order to address a higher sustainability demand by our societies. However, CO_2 being a waste compound from combustion processes, also represents an interesting building block for various chemicals that incorporate this carbon-based synthon. In this regard, it may thus offer an alternative feed stock (at least partially) for petroleum-based carbon compounds that are currently dictating chemical manufacturing. Since petroleum resources are expected to become depleted in the near future, alternative methodologies towards value-added organic materials will be warranted. As such, catalysis research focusing on the conversion/fixation of CO_2 into useful chemicals is an ever-expanding area of science aiming at new opportunities for the use of this renewable and cheap small molecule.

Undoubtedly, catalytic technologies have become crucial for conversion of CO_2 as it represents a highly stable entity with catalysts lowering the energy requirements for effective turnover. Catalysis thus helps to shape a greener landscape for CO_2 conversion by minimizing waste and optimizing the energy balance and CO_2 net output of chemical processing. Obviously, at this moment none of the current catalytic technologies is able to address effectively the current CO_2 emissions as the joint chemical activities to convert it are taking place at a much lower scale. Nonetheless, common awareness among scientists and politicians has led to a better definition of the problems associated with global CO_2 emissions. The prospects that may arise by using it as a readily available raw material seem to be growing by the year.

This focused issue on the use of carbon dioxide with the aim to convert it into more useful organic matter intends to present leading groups in the area of CO_2 research to showcase the most recent developments and advances made. While CO_2 capturing techniques have an even longer tradition, here its catalytic conversion has been chosen as a theme to provide a stimulating scientific discussion how we can benefit from this carbon feed stock. Both homogeneous and heterogeneous catalysts have been developed over the years for effective CO_2 conversion and this themed issue nicely reflects on these activities. Furthermore, these combined efforts explore the versatile use of CO_2 in the assembly of various organic molecules including methanol, (polymeric) organic carbonates, quinazoline-4(1*H*,3*H*)-diones, formamides and methyl-amines. This cutting edge research should set the stage for future directions in CO_2 chemistry and catalysis with ample opportunities in the synthesis of bulk chemicals, pharmaceuticals and new (polymer) materials. A growing (mechanistic) understanding of CO_2 conversion technology is expected to contribute to bridge the gap between academic and commercial targets, and this field of science may offer new options for innovative, multidisciplinary approaches. A big thanks goes to all contributors of this special issue who have done a great job in presenting this highly active area of research. In my view, we are now at a stage where new/further exciting developments and discoveries are in reach.