EDITORIAL: Special Issue on the Membranes for Carbon Dioxide Separation / Capture Applications

Today the carbon dioxide (CO_2) concentration in Earth's atmosphere is between 0.036% (360 ppm) and 0.041% (410 ppm), depending on the location. Carbon dioxide is the fourth earth gas in concentration after the nitrogen (N_2), oxygen (O_2) and argon (Ar). Although carbon dioxide is a naturally occurring gas that existed in the atmosphere long before humans and it is not classified as a toxic or harmful gas, the rising of CO_2 levels causes an enhanced greenhouse effect. Over the past ten thousand years, the level of atmospheric CO_2 in the atmosphere has remained at relatively stable levels. However, human CO_2 emissions over the past few centuries have upset this balance. The increase of CO_2 concentration has some direct effects on the environment. For example, as the oceans absorb CO_2 from the atmosphere, it leads to acidification that affects many marine ecosystems. However, the rise of CO_2 has a main impact on the environment provoking warmer temperatures.

Along with peace, immigration, food, clean water and energy, the sustainable treatment of the exhaust gases and the reduction of fuel burning processes thus remain the most significant challenges to face global society in the 21st century. What are the sustainable solutions to these challenges? New meetings of the G20 group, more and more new strict laws, and further growth of the carbon credits market are not the answer. Especially by the last action the unique winners are those who create this new big money market around the CO_2 production and it is absolutely sure that overall people and nature are the two big losers. And where are the solutions? To anyone who consume less and less products, to anyone who burn less and less fuels and minerals and to anyone who decide to be more and more energetic frugal citizen. But, first of all science and technology must give potential solutions and treatment to this problem. To this end, membrane science and nanotechnology are set to play key roles as enabling technologies, promising future solutions to this challenge with low resource consumption and reasonable price.

In particular, the development of new technologies for the reduction of CO_2 emissions as well as the improvement of new technologies for CO_2 separation and capture have been established as main priorities for scientists and governments worldwide. Furthermore, the ability to use the CO_2 by its transformation as a resource for the production of chemicals, materials (polymers) and fuels increase the necessity to dispose technologies for CO_2 separation. To this purpose, membranes can play an important role thanks to their ability to separate gases with different physical and chemical properties. Especially, both polymeric and inorganic materials are good candidates for CO_2 separation due to the remarkable separation mechanism of carbon dioxide. Of course the advantage of the membrane technology to separate gas mixtures without high energy requirement makes this field more and more attractive!

By this special issue the Journal of Membrane and Separation Technology gave the opportunity to the scientists who are working on the field of membrane technology for CO_2 separation and capture to present, share and discuss with the membrane community their recent findings and ideas. Unfortunately, due to the strict time-chart of the publication process of this special issue several authors were out of the deadlines and therefore their works didn’t have the opportunity to be examined.

Finally, I would really like to acknowledge all those who by different way contributed to this special issue, including the Journal of Membrane Science and Technology people and of course the authors and the reviewers. The strong support given by Ms Ambreen Murtaza from the Lifescience Global publication department is also greatly appreciated.

Evangelos P. Favvas
Guest Editor
Membranes and Materials for Environmental Separations Laboratory
Institute of Nanoscience and Nanotechnology
National Center for Scientific Research “Demokritos”
Aghia Paraskevi – Athens, Attica, Greece
E-mails: e.favvas@inn.demokritos.gr, e.favvas@gmail.com