Extending the application of high pressure engineering

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INTRODUCTION

Supercritical gases are called “green solvents”. This is a concept that allows for the sustainable production or separation of high technology products. “Sustainable” refers to the potential longevity of vital human ecological support systems, such as the planet's climatic system, systems of agriculture, industry, forestry, and fisheries, and human communities in general and the various systems on which they depend. Carbon dioxide is the gas focused most. It is a part of earth’s atmosphere and non-toxic. But for high pressure applications, it must be (re-)compressed, is harmful to the world’s climate and needs big steel apparatus produced under the use of energy. I prefer to call supercritical gases to be “advanced” fluids.

OVERVIEW ON EUROPEAN RESEARCH LOCATIONS

Europe is very strong in the research for high pressure and supercritical technology. A survey is given on a map what can also be found at the following internet address: http://www.tvt.cbi.uni-erlangen.de/eng/research/index_research.html

IONIC LIQUIDS

Ionic liquids (IL) have a really low vapour pressure that seldomly exceeds 10^{-4} Pa. So the IL cannot evaporate and thus stays at the site of use.

IL’s can be tailored to the field of application. Because of the plenty of possibilities to select cations and anions, a predictive method for thermophysical data is needed. Such a method is COSMO-RS which is based on quantum chemistry and is fully predictive without any adjustable parameters.

The lecture demonstrates the benefits using IL’s in the contruction of the ion compressor [1].

SUPERCRTICAL SOLVENTS FOR FIBRES

Since the discovery of the solvent power of supercritical solvents in Germany and its use in the decaffeination of coffee and tea and the extraction of hop, a real industrial application beyond the production of poly-ethylene has not yet been discovered.

An interesting field of application is the use in electro-spinning under supercritical conditions, a process proposed by Mark McHugh in US. The status of this process is demonstrated.

CLIMATE CHANGE

The supercritical state is important in climate change. It is beyond discussion that the emission of green house gases, especially CO_2, is not benign to the climate. Developing countries like India or China will refrain from stopping its economic development because of the urgent wish of industrial states. The only chance to escape is the capture of CO_2 from emissions and its storage [2]. The sites for storage are the deep sea and the underground. Both sites need to be explored and principles of the high pressure technology must be applied. In the deep sea we find the clatharates of CO_2 and water similar to those what we know from methane and water in pipelines. In the underground the CO_2 is stored as a supercritical phase, dissolved in salt water, adsorbed to rocks or reacted with base compounds. Again, principles of thermodynamics are applied what we know from the design of chemical processes.

CONCLUSION

Advanced fluids will play an important role in a world that wants to keep the standard of living in the industrial states and tries to improve the state of developing countries. Advanced fluids are a wonderful example for a world-wide cooperation, finally demonstrated by this conference.

REFERENCES :

[1] Tim Predel, Eberhard Schlücker, Peter Wasserscheid, Dirk Gerhard, Wolfgang Arlt,: Ionic Liquids as Operating Fluids in High Pressure Applications Chem. Eng. Technol. 2007, 30, No. 11, 1475-1480

[2] W.Arlt, Engineering solutions for limiting the increase of atmospheric carbon dioxide, Chemical Engineering & Technology 26(12) (2003), 1217-1224