

## Back to the future: Distillation and absorption in the era of bio, info and process intensification

Distillation and absorption are the main work horses of the chemical process industries, but are highly energy intensive processes: Distillation of hydrocarbons from crude oil consumes energy equivalent to the total energy consumption of the United Kingdom in 2014; energy sufficient to power roughly 40 million homes is needed to separate cyclic hydrocarbons through distillation worldwide; and the energy sector emits more than 30 gigatons of CO<sub>2</sub> worldwide, equivalent to about two thirds of total CO<sub>2</sub> emissions, which must be recovered through efficient absorption/desorption systems. Solving the global challenges of tomorrow will require smarter, better, and more creative separation solutions.

This lecture will show how efficient distillation and absorption technologies can, and must, contribute to solving the global challenges we are facing today, but more importantly, the challenges future engineers will be facing in the coming decades. Some examples that will be considered:

- biomaterials and advanced fluids for separations
- enzymes in distillation and absorption
- intensification of absorption and distillation in modular devices or centrifugal fields
- membrane assisted separations
- intensification of absorption through membrane contactors.

Mathematical modelling of distillation has a tradition of about 100 yrs. During this period tremendous progress in terms of computational efficiency and modelling accuracy has been achieved. Models developed for multi component distillation or reactive separations can now be used for design of novel processes like enzymatic absorption or HiGee distillation. The lecture shows that there is nothing more practical than a good theory. It also demonstrates why it is important to revisit old ideas for separation processes taking into account the modern design tools and experimental techniques.

### Professor Andrzej Górak



Professor Andrzej Górak, obtained his Ph.D. from TU Lodz in Poland where he remained as senior researcher until 1988. The following four years he spent as a researcher at Henkel KGaA in Düsseldorf. Having completed his "habilitation" at RWTH Aachen and at Technical University Warsaw, Andrzej Górak became professor and the Chair of Fluid Separation Processes at TU Dortmund University, Germany in 1992 and has remained there ever since, only interrupted by a short period at the University of Essen in 1996-2000. In addition, he has been full professor at the Technical University of Lodz since 2003.

Professor Andrzej Górak's work is mainly focused on simulation and experimental validation of intensified separation processes such as integrated reaction and separation processes, reactive distillation and reactive absorption, as well as on the analysis of hybrid separation processes and the purification of biotechnological products. In 2014, Professor Gorak was awarded with the Kirschbaum-Medaille by DECHEMA and Verein Deutscher Ingenieure for his outstanding achievements in fluid separations, and in he was awarded the Federal Cross of Merit of the Federal Republic of Germany (2010) and Republic Poland (2013).

Professor Górak has been a longstanding editor of the Chemical Engineering and Processing: Process Intensification journal, he was a co-editor of the series of three books on distillation which was awarded the PROSE award in the Chemistry and Physics category in 2015, and he is the author of about 300 peer reviewed papers, 15 patents and 5 co-edited books.