

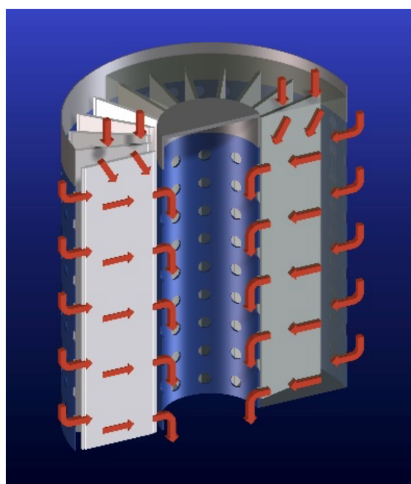
**Casale Strategy in ammonia synthesis: How to use engineering solutions to exploit the maximum benefits of the catalysts**

P. Biasi<sup>1,2</sup>, E. Filippi<sup>1</sup>

<sup>1</sup>Casale SA, Lugano, Switzerland, <sup>2</sup> p.biasi@casale.ch

CASALE is a global supplier of technologies and engineering solutions for the production of Ammonia, Urea, Methanol, Nitrates, Phosphates, complex fertilizers, Syngas and Melamine. With a large number of revamping projects successfully carried out in the last decades, CASALE is now the world leader in plant revamping and its technologies are installed in many ammonia, urea and methanol plants all over the world. Among all the activities, ammonia technology is the first and the most important core business of Casale.

Catalytic ammonia synthesis from  $H_2$  and  $N_2$  represents one of the most important industrial reactions today and despite the Haber-Bosch process being more than 100 years old [1], only slight improvements have been achieved until recently. The reaction  $3H_2 + N_2 = 2NH_3$  ( $\Delta H^\circ_{298} = -92$  kJ/mol) is favoured by higher pressure according to the Chatelier principle and, as it is an exothermic reaction, the lower the temperature the better the equilibrium concentration of ammonia. CASALE along the years has worked to optimize the performances of the catalyst-reactor symbiosis. The technology developed to maximize the performances of the ammonia synthesis catalyst developed by CASALE was the axial-radial reactor (Figure 1).



*Figure 1: Axial-radial reactor*

For this reason, the design of ammonia converter is a demanding chemical engineering task and Casale has always invested in the research for a new type of reactor that could valorise the performance of the catalyst. Recently Casale has developed together with CLARIANT the new Amomax-CASALE catalyst, that together with a new proprietary CASALE design for ammonia converters, allows to maximize the production of ammonia.

Therefore, through the understanding of the performance of the catalyst it is possible to improve and optimize the design of the reactor, offering new engineering solutions to valorise the catalyst and the entire process.

[1] L. Huazhang, *Chem. Industry Press*, **2013**