

Chemical Reactors development & prototyping at ICI Caldaie

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Highlights

- Joint reactors development together with academies and research centers
- Chemical reactors prototyping
- Scaling size: from lab scale (TRL 5) up to truck transportable reactors (TRL 6 to 9)

1. Introduction

The activity of ICI Caldaie started 60 years ago in the business of high temperature and high pressure boilers (up to 850°C and 30 bar). Nowadays ICI Caldaie is recognized as a world leading industry in this business.

In the early 2000' ICI Caldaie became aware that chemical reactors were the proper and natural way to exploit the high level reached by its R&D department and started a dedicated laboratory called "ICI LAB".

Since the beginning of the activity "ICI LAB" created synergies between its academic partners and the industrial department of ICI CALDAIE, becoming a player able to have an holistic approach to the reactors business, starting from joint design solutions, through feasibility studies and up to the manufacturing and industrialization of the reactors. Partnerships with universities, research centers and other industries all over the world have led to many projects (Internal ¹, National ^{2,3}, European ^{4,5}) focused on the realization of chemical reactors.

2. Methods

Thanks to its fully-equipped laboratory and a rapid setup manufacturing unit, provided with data acquisition and analyzing tools, the implementation and testing of new developed solutions is now a routine at ICI Caldaie.

The normal course leading to the development of a new reactor foresees the following steps: Identification and evaluation of a potential product and its applications - Market analysis - Feasibility study - Consortium creation - Project preparation - Sharing technology and knowhow - Joint development - Patent application - Design and Prototyping - Lab testing - Integration and Installation - Field test - Production and Commercialization.

3. Results and discussion

The first field of application was identified in the onsite hydrogen production from natural gas and Bio gas. Different reactors for hydrogen production were developed according to different sizes (from 3 to 50 Nm³/h) and different grades of purity for different hydrogen applications.

The more traditional designs based on fixed bed catalyst with temperature up to 850°C and pressure up to 2 bar are now running alongside with innovative designs based on membrane reactors with fluidized bed catalyst, with temperature up to 600°C and pressure up to 12 bar.

Together with hydrogen production and purification, the experience and knowhow acquired so far range from "CO₂ capture and sequestration", "gas to liquid reactors" to several other systems.



Figure 1. Different phases in the prototype of chemical reactors at ICI Caldaie.

4. Conclusions

Thanks to ICI manufacturing capability and proven ability of good knowledge transfer between industry and university, ICI is now well ready as a potential partner for reactors development and prototyping.

References

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Keywords

Reactor prototyping
Industrialization