

**Participate in the Indus Scholar Program of Indus MAGIC &
Contribute to realization of MAGIC (Modular, Agile, Intensified and Continuous)
Processes and Plants for Fine & Specialty Chemicals**

Specialty chemicals sector caters to several key applications required for maintaining and enhancing quality of life. To fulfill the demands for hitherto unmet and ever growing needs as well as expectations of a rapidly developing India, it is expected to grow at nearly double the rate of growth of overall economy. This offers unprecedented new opportunities for science, technology and innovation.

Indus MAGIC is a large research program conceived by chemical cluster laboratories of CSIR with CSIR-NCL (Council of Scientific & Industrial Research – National Chemical Laboratory) as a nodal laboratory. The program targets development of new and creative ways of designing process equipment and their integration with process chemistry to realize atom efficient, environmentally benign and globally competitive processes and technologies. The MAGIC (modular, agile, intensified and continuous) processes and plants will be developed based on the following concepts:

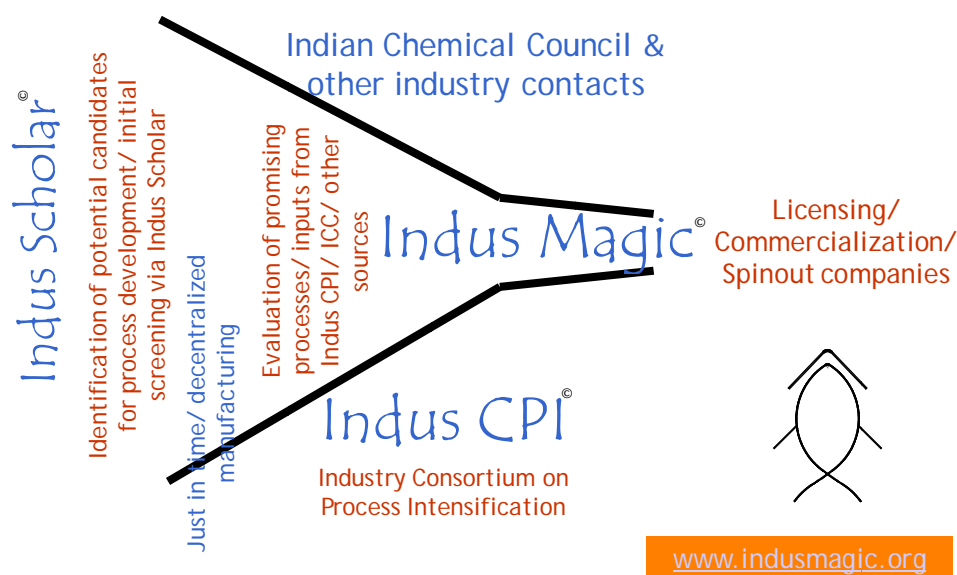
| Conventional way | MAGIC way |
|---|--|
| Batch or semi-batch processes | Continuous processes |
| Stirred reactors | Compact, intensified reactors |
| Less flexible plants, clumsy cleaning | Modular, agile and reconfigurable plants |
| Use of stoichiometric reagents | Use of catalysts & catalytic processes |
| Generate significant waste per unit product | Intensified processes/ operation to maximize atom efficiency |
| Large water foot print | Reduced water foot print via water recycle and reuse |
| Use hazardous solvents | Conduct reactions in water/ benign solvents |
| Reactions limited by transport limitations | Reactions at intrinsic rates without any transport limitations |
| Separate unit operations: reactors, separations | Integrated processes with multi-functional reactors/ process equipment |
| Cabled process instrumentation & control | Wireless process instrumentation & control/ new paradigms for process optimization |

It is important at this juncture to focus on the following key components to develop and harness these MAGIC concepts and technology:

- Modular nature of devices: modular nature of devices and process equipment will significantly reduce field work and will shrink the time for translating laboratory research to practice. It is essential to develop new types of modular devices and develop standards as well as interoperability policies for assisting development of new and better modular devices
- Ability to adopt process changes: rapid changes in the market requirements demand a step change in ability of process plant to reconfigure and adapt to the market requirements. New research and design methodologies are needed for this purpose.

- Intensified transport processes: Despite significant research on development of intensified process equipment, further research and focus on developing intensified processes is needed to incorporate some of the learning (causes for the disillusionment) of the last decade.
- Continuous processes: it is essential to harness advantages of continuous processing without significantly losing the advantages of batch (like flexibility and multi-product ability) processes.

There are several challenges in realizing this dream of MAGICally transforming the way specialty chemicals are manufactured. Some of these are technical and even more difficult ones are non-technical. To negotiate some of these challenges, it is essential to involve large number of chemical engineering and process chemistry students in the program to sensitize them with the concepts of MAGIC plants and processes. These students will eventually work in the industry and will facilitate implementation of MAGIC concepts in industry and realize the desired transformation of the way we manufacture specialty chemicals today. The overall structure of the program is shown in the following:



The Indus MAGIC team is inviting association of faculty and final year students of chemical engineering colleges/ institutes. This association is in the form of undertaking final year projects of chemical engineering students in the areas relevant to Indus MAGIC. More information may be obtained from www.indusmagic.org. We invite faculty members interested participating in this program to registers on this website. The Indus MAGIC team will then work with the registered faculty members to formulate appropriate Indus Scholar projects. These projects will be archived on the web and will eventually create a valuable resource for developing MAGIC processes. We hope to see your participation in this ambitious program of MAGICally transforming the way specialty chemicals are manufactured in India. Please contact Dr Ranade on following address for more information.



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