3D PRINTING IN THE PROCESS INDUSTRY

FROM DESIGN TO INDUSTRIAL PILOT

Carlos A. Grande

SINTEF. Forskningsveien 1. Oslo, Norway.

How design changed our society?

New buildings are not just buildings. They are "human-centered designed": functional, energy efficient, eco-efficient, etc.

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Market revolutioned by design

Main functionality (transport) was flavoured with speed, safety, easier operation, etc.

Process industry is also looking for these "flavours"…

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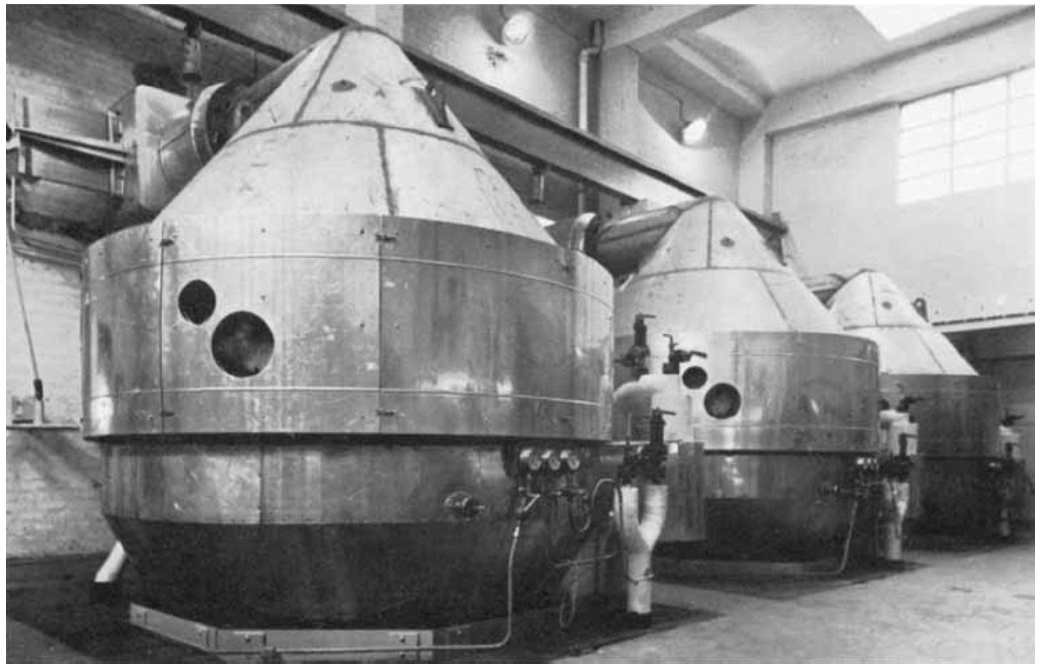
Meanwhile in the chemical industries…



Plant in 1924

Plant in 2008

Are we using the design capabilities that we have now?

~~Some aspects of 3D printing~~

Some myths about 3D printing

Is very expensive.

Is slow for mass production

Is only worthy for limited markets

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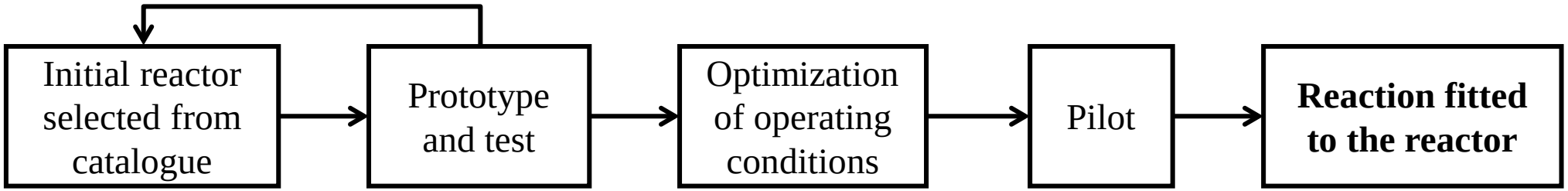
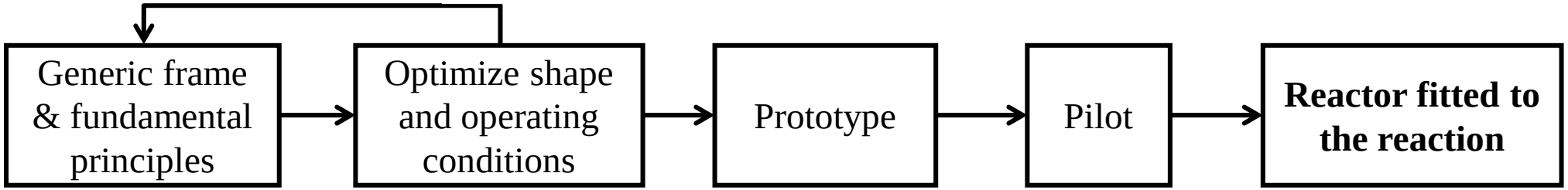
What is the advantage of 3DP for process industry?

Current reactor design & optimization



New paradigm in reactor design & optimization



Design the best reactor for your particular purpose

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Applied design

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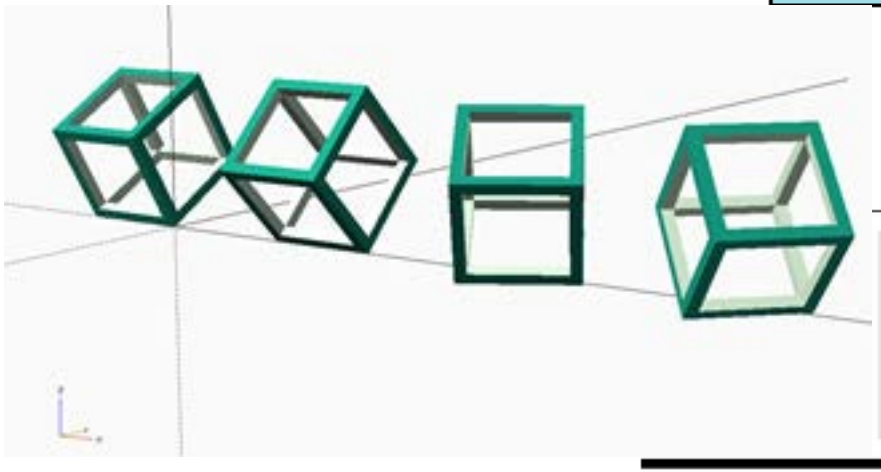
- Design the "perfect" foam. A foam where all cells are equal and where you can tailor porosity.

Shape	Porosity	Strut width
Cubic cell	$\varepsilon_f = \frac{[3(L-P)P^2 - 2P^3]}{L^3}$	$(L-P)$



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Pressure drop and heat transfer properties of cubic iso-reticular foams

Núria F. Bastos Rebelo[a], Kari Anne Andreassen[a], Luis I. Suarez Ríos[b], Juan C. Piquero Camblor[b], Hans-Jörg Zander[c], Carlos A. Grande[a,*]

[a] SINTEF Industry, P.O. Box 124, Blindern, N0314 Oslo, Norway
[b] PRODINTEC Parque Científico Tecnológico de Gijón, Avda. Jardín Botánico, 1345, 33203 Gijón, Asturias, Spain
[c] LINDE AG, Engineering Division, Dr.-Carl von Linde Straße 6-14, 82049 Pullach, Germany

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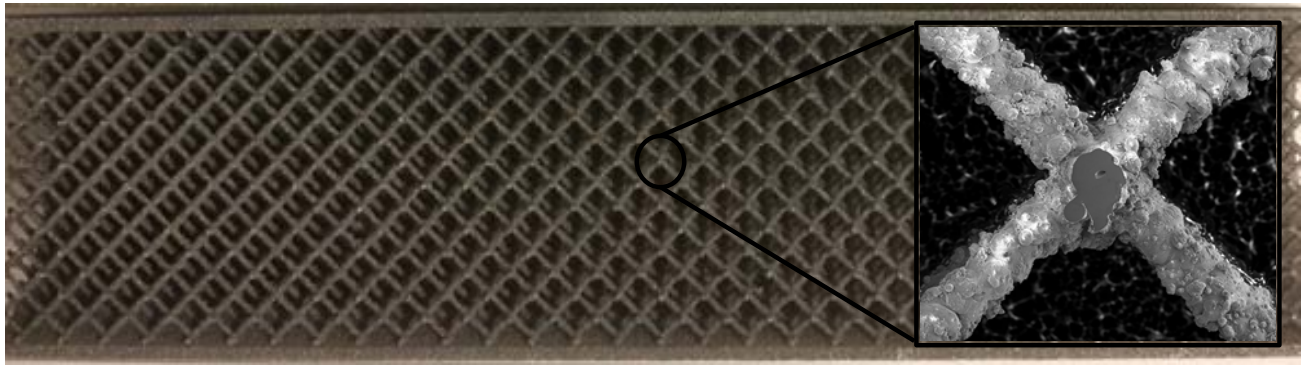
Industrial design

- Tailor properties for pressure drop and heat transfer and scale-up.



For which application?

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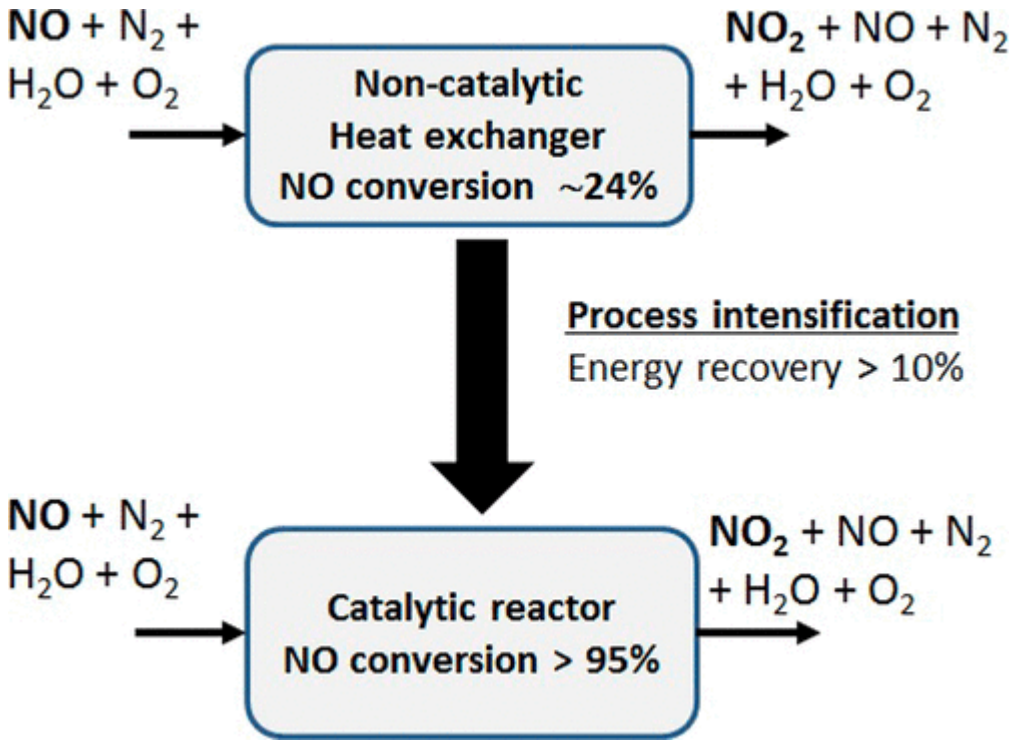
- First-time trial of catalytic NO oxidation to NO_2 for nitric acid production.



I&EC research
Industrial & Engineering Chemistry Research

Article

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Process Intensification in Nitric Acid Plants by Catalytic Oxidation of Nitric Oxide

Carlos A. Grande,*[†] Kari Anne Andreassen,[†] Jasmina H. Cavka,[†] David Waller,[‡] Odd-Arne Lorentsen,[‡] Halvor Øien,[‡] Hans-Jörg Zander,[§] Stephen Poulston,[∥] Sonia García,[∥] and Deena Modeshia[∥]

[†]SINTEF AS, P.O. Box 124 Blindern, Oslo N0314, Norway
[‡]Yara International ASA, Yara Technology Centre, P.O. Box 1130, Porsgrunn 3905, Norway
[§]LINDE AG, Engineering Division, Dr.-Carl von Linde Straβe 6-14, Pullach 82049, Germany
[∥]Johnson Matthey Technology Centre, Blount's Court, Sonning Common RG4 9NH, United Kingdom

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First industrial pilot

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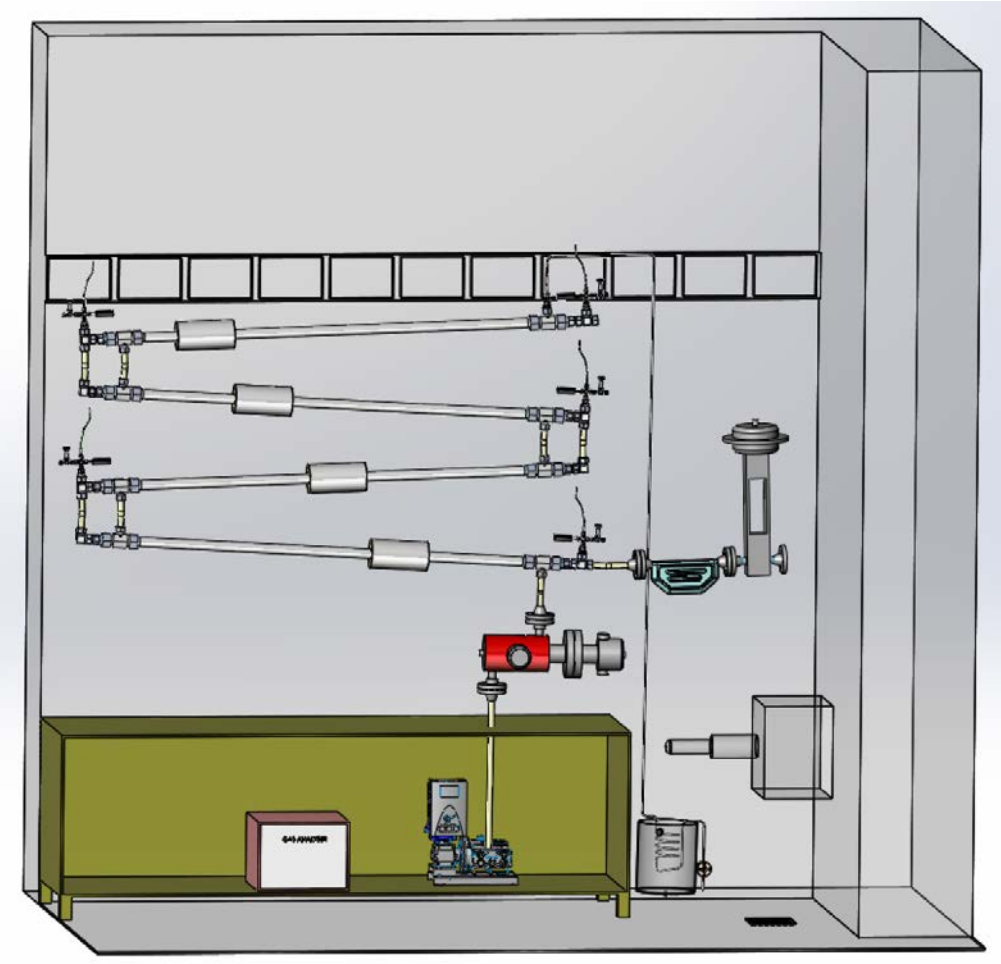
- Catalytic converter of 7.5m installed in Yara (Porsgrunn).



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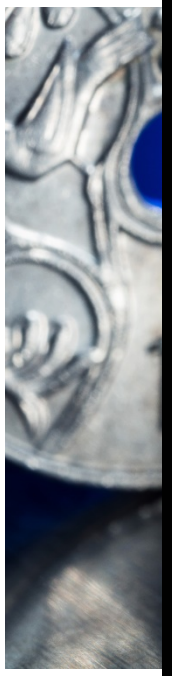
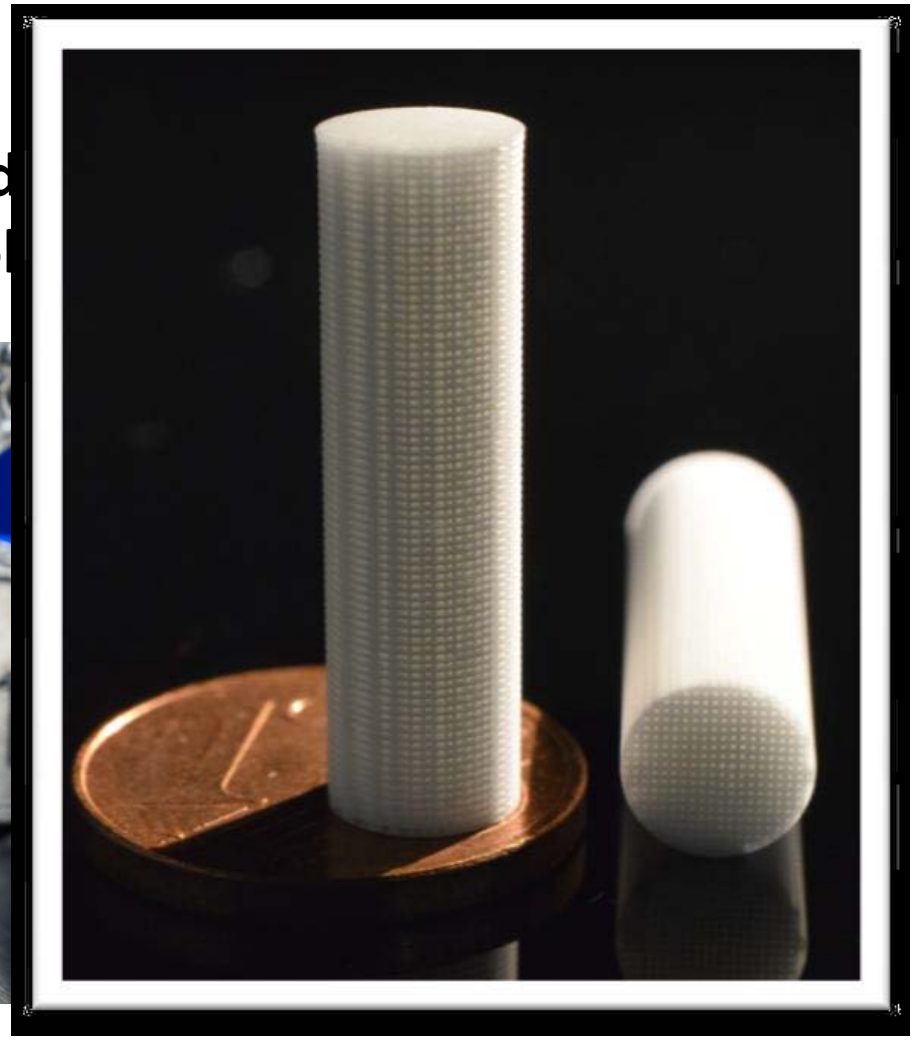
This is also extensible to other areas

NO oxidation and hydrogenation reactions

Prod
monol





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Paving the future: education

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First European school for additive manufacturing applied to chemical industries

Free registration

When: 30-31/08/2018

Location: Location: ICPF CAS, v .v. i, Prague, Czech Republic. http://www.icpf.cas.cz/en/contacts.

Program outline

30/8	
08:30 – 09:00	Registration and gathering together
09:00 – 09:15	Welcome speech
09:15 – 10:00	Fundamentals of 3D printing. Technology overview with real samples. (Petr Bláha, 3DARENA, Prague, Czech Republic)
10:00 – 11:00	3D printing by Prusa Research: present and the future, Jakub Doležal, Prusa Research, Prague, Czech Republic
11:00 – 12:00	The basic printing process, Jakub Doležal, Prusa Research, Prague, Czech Republic
12:00 – 13:00	LUNCH
13:00 – 14:30	The first step in 3D printing. Build your CAD & render. Do your first printout. (FDM, SLA printers, Prusa Research, ICPF)
14:30 – 15:30	What 3D printing can deliver to chemical industries?
15:30 – 16:00	Break / coffee
16:00 – 17:00	Application of 3D printing for the chemical industries.
(Laboratory tour at ICPF with relevant demonstration examples of 3D printing utilization)	

31/8	
09:00 – 09:30	Pickup and Check your printouts. Discussion
09:30 – 10:15	3D printing comes with advanced modelling
10:15 – 11:00	What we need to learn deeper to incorporate 3DP in our CV?
11:00 – 12:00	Speaker 1. Advanced 3D printing of ceramic materials. Dr. Martin Schwentenwein Lithoz GmbH, Austria.
12:00 – 13:00	LUNCH
13:00 – 14:00	Speaker 2. 3D printing of chemical reactors.
14:00 – 15:00	Speaker 3. 3D printing for chromatography. Prof. Simone DiMartino. Edinburgh University, United Kingdom.
15:00 – 15:30	Break / coffee
15:30 – 16:30	Speaker 4. 3D printed catalysts. Dr. Vesna Middelkoop. VITO, Belgium.
16:30 – 17:00	Final remarks, picture and delivery of certificates.

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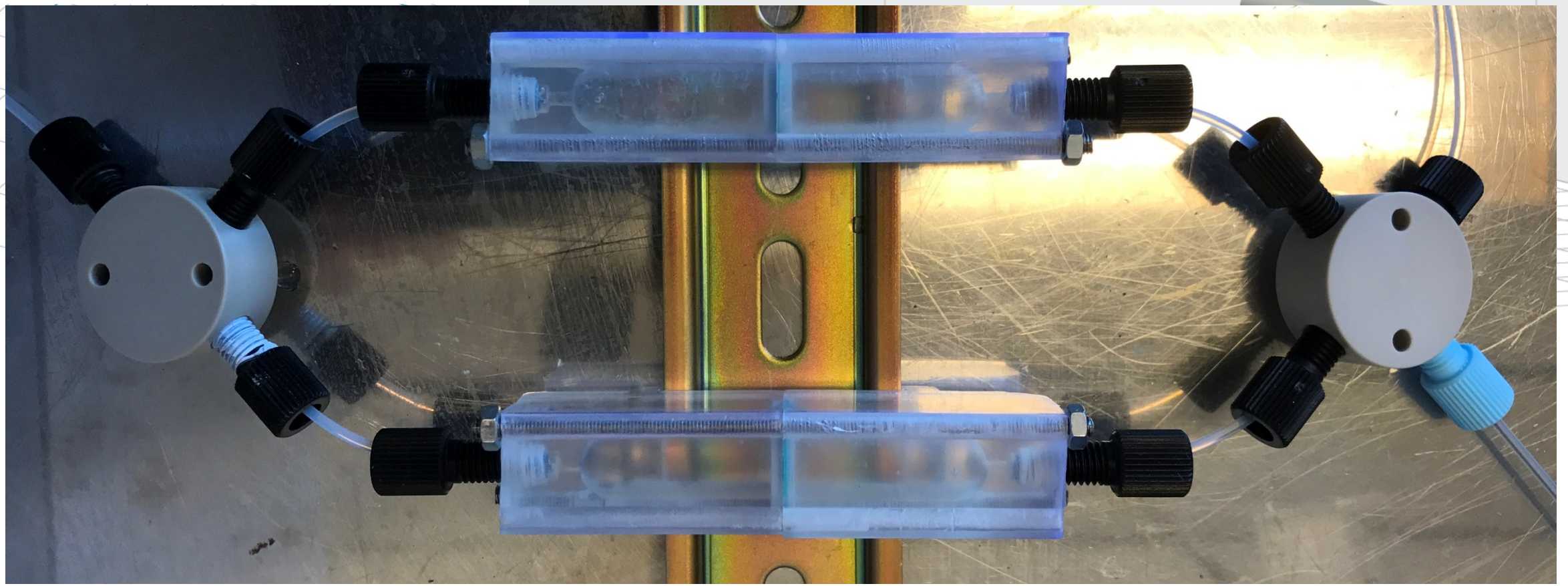
Modules to teach more than chemistry

DIN rail dimensions



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Our projects & partners

Started in 2018!

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Acknowledgments

PRINT CR3DIT

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Technology for a better society