



borit[®]

Flexibility | Quality | Productivity

Your partner for industrial sheet metal solutions

Company

Background

- Borit NV (www.borit.be) is a spin off company of OCAS NV (www.ocas.be) - a metal research center belonging to ArcelorMittal and the Flemish Region - and Borit GmbH (www.borit.de)



borit[®]
Leichtbau-Technik GmbH

Milestones

- 2003: incorporation of Borit Leichtbau-Technik GmbH, Herzogenrath - Germany
- Q1 2010: incorporation of Borit NV, Geel - Belgium
- Q3 2011: opening of Japan office in Yokohama - Japan
- Q3 2012: opening of North American office in Cleveland, Ohio - USA

Vision

Become a **global industrial and logistical partner**
in **high precision sheet metal components & subassemblies**,
offering significant customer value
through

Flexibility

- Easy to do business with
- Flexible value chain positioning
- Flexible & extreme product design

Productivity

- Fast
- Cost efficient

Quality

- Reduce post processing cost
- Guarantee perfect consistency

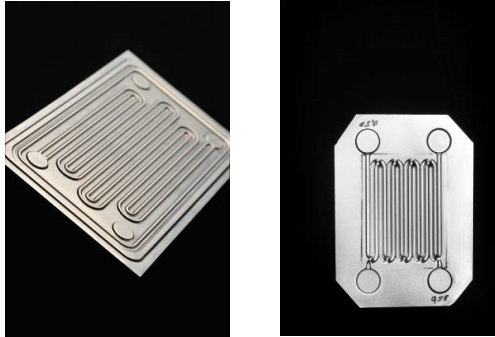
Risk reduction

- Low upfront costs
- Delay the need for investment

Solutions & target markets

1

Fuel cell & electrolyser



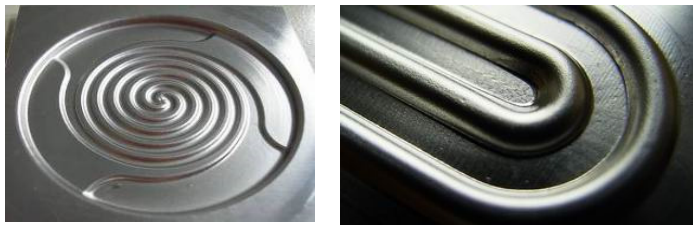
Market size > 1B\$ - CAGR 100%

>25 Customers = 70% TO

- Automotive
- Residential
- Back up power
- Energy storage
- Aviation
- Consumer electronics
- Logistics
- ...

2

Thermal management



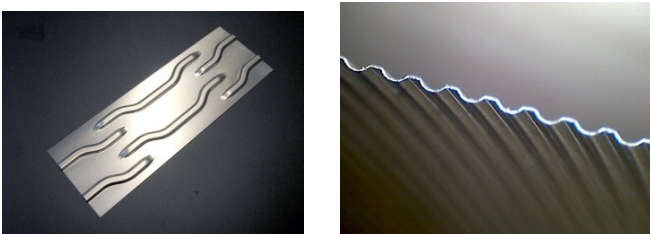
Market size > 12B\$ - CAGR <5%

Niche segments = 25% TO

- Automotive: battery thermal management for EV / compact plate heat exchangers for exhaust systems
- Power electronics: cooling / cold plates
- Residential: compact heat exchangers

3

Process intensification



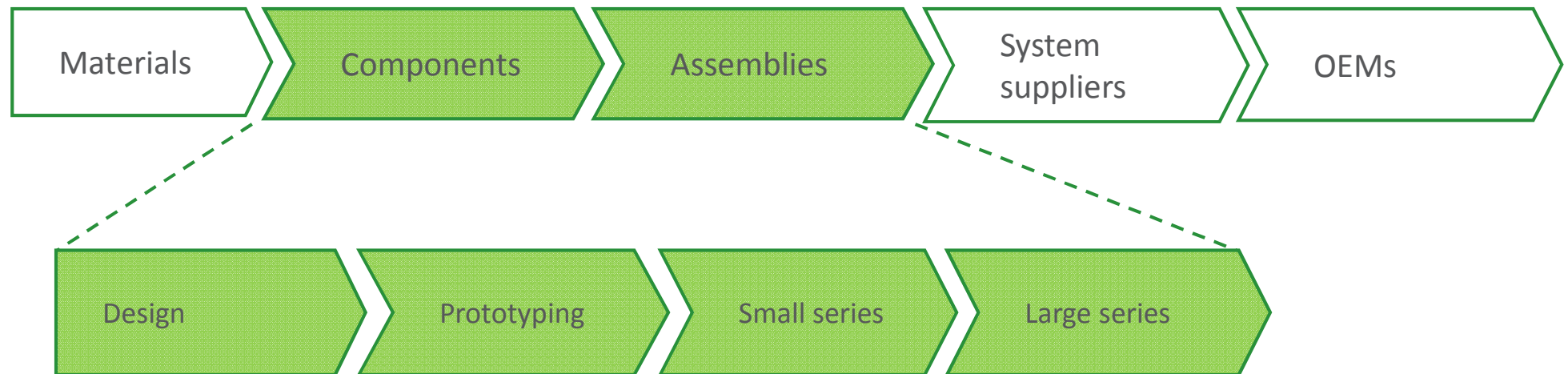
Emerging Market

Engineering projects = 5% TO

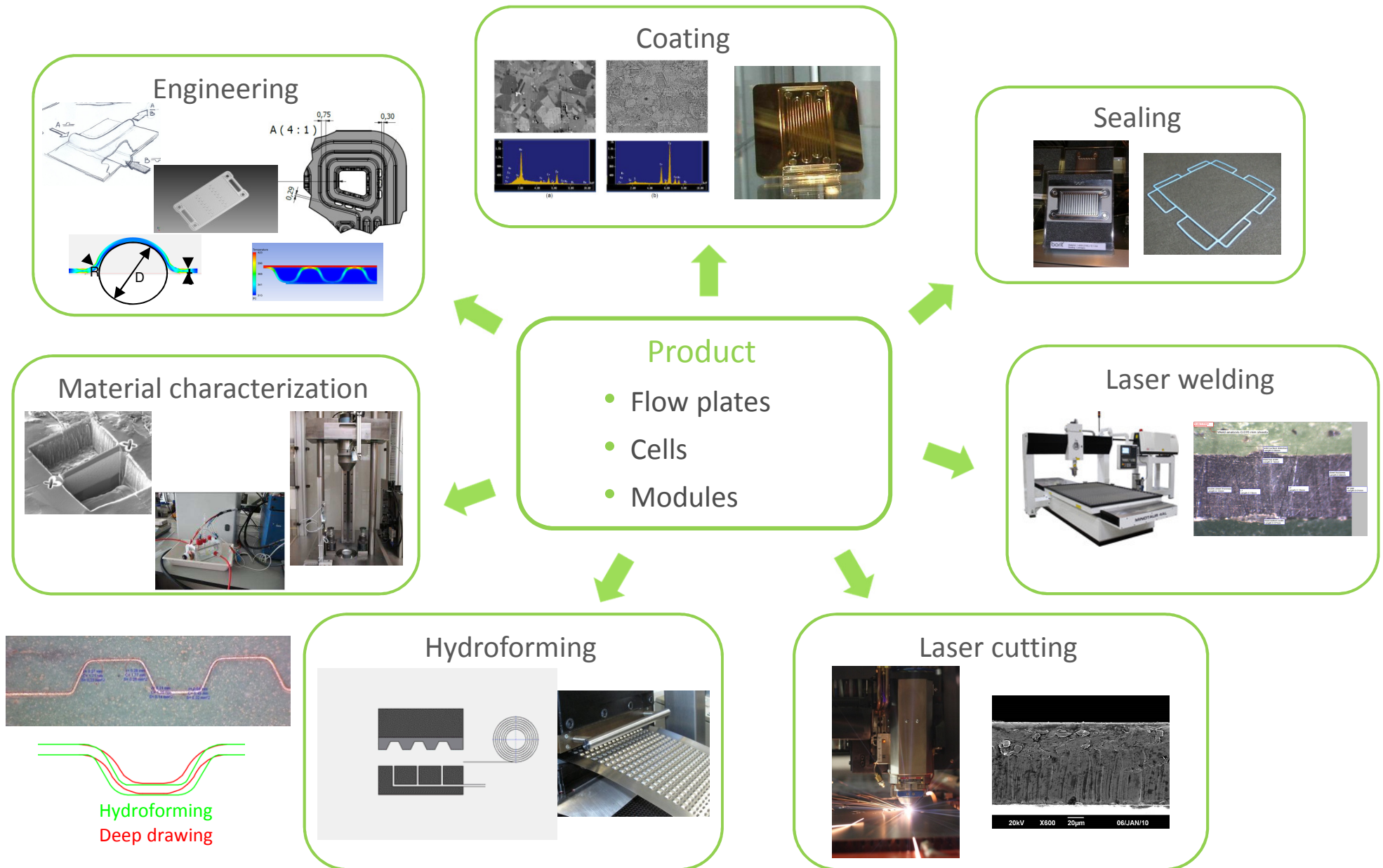
- Micro and continuous flow reactors
- Mixer and droplet modules
- Chemical, pharmaceutical and food industry

Value chain positioning

- In the value chain Borit positions itself as a **total solution provider** to system suppliers delivering components and assemblies



Competencies & products



Fuel cell & electrolyser

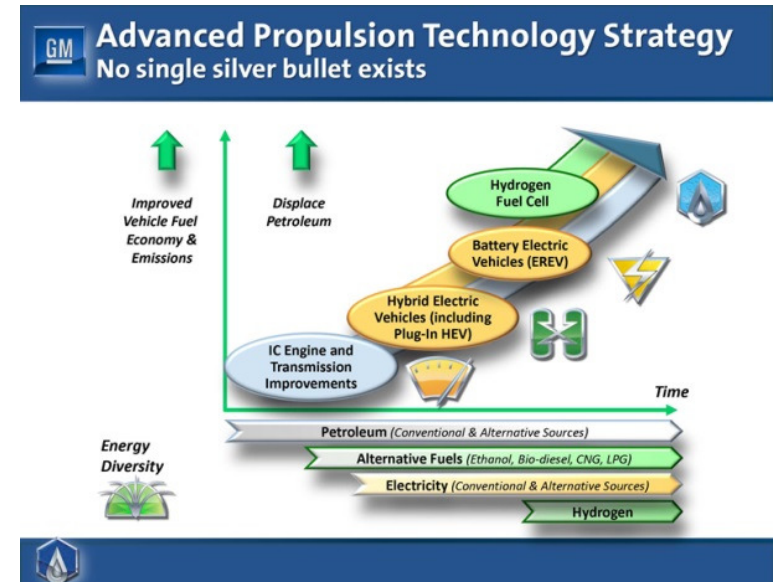
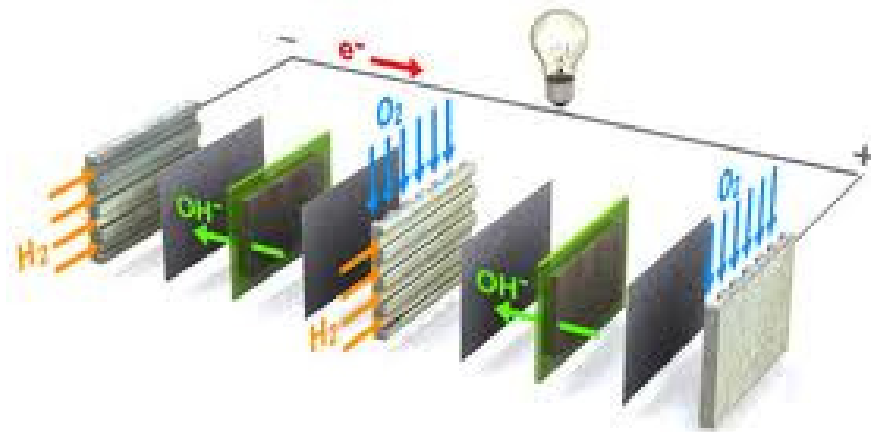
Market

- Fuel cells
 - early-stage market with an estimated growth rate of over 100 % over the next 5 years
- Electrolysers
 - more established market with high growth potential

Positioning

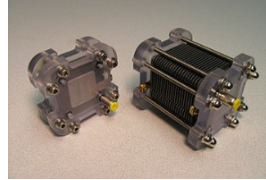
- Borit commercializes, develops and manufactures metal bipolar plates and sub-assemblies
- Borit aims at being an **industrial and logistic partner**, supplying its customers with sub-assemblies ready for integration in the stack assembly process

Principle & forecast



Fuel cells in automotive

- Basics = fuel cell + balance of plant equipment + electrical motor



- Developments & commercial types in automotive

- Hyundai ix35



- GM Gen2 / Chevrolet Equinox



- Nissan Terra FCEV
Nissan Leaf FC



- Toyota



Fuel cells in other applications



■ Industrial power generation (e.g. remote off-grid or H₂-process waste)

- Solvay Antwerp plant – Nedstack



- Uninterruptible power supplies (UPS)

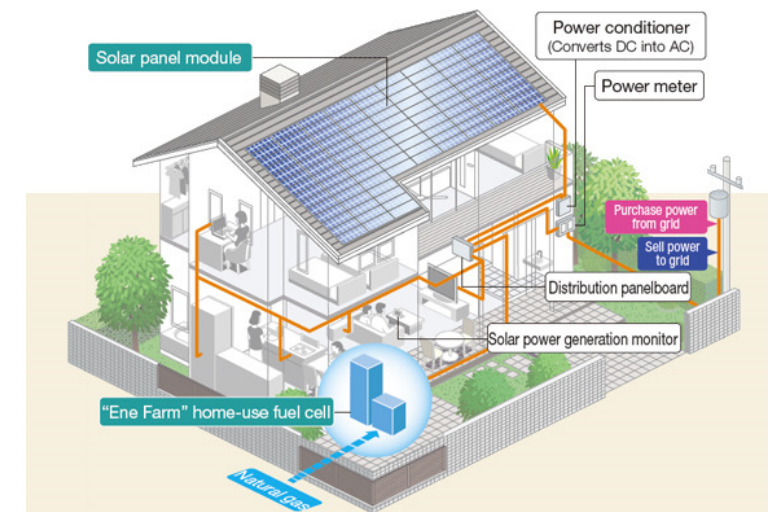
- For use as back-up power in computer server installations
- Remote Mobile Phone Antenna stations



■ Stationary power generation

- Housing market :

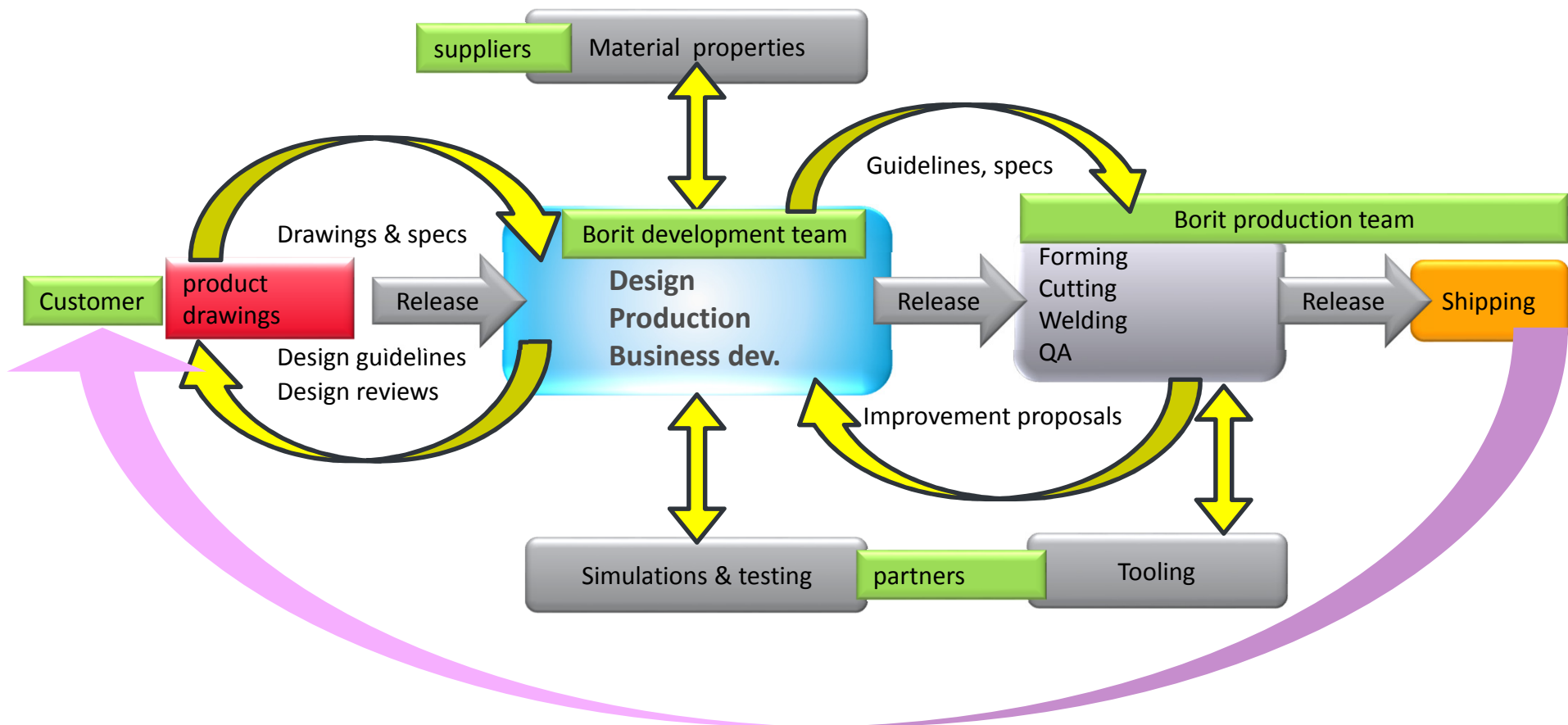
- Panasonic
- Future zero emission house: PV + FC + geothermal



Simultaneous Product & Process development

■ Process flow

- Multidisciplinary approach
- Intensive communication with all parties involved: internal & external
- Requirements from all processes and partners are taken into account from the design phase



Simultaneous Product & Process development

- Different perspectives have to be taken into account
 - Customer requirements
 - Specifications & quality requirements / functionality of the product
 - Cost
 - Added value by potential Borit improvement proposals
 - Business development perspective
 - Profitability of the project
 - Correct or new target markets – Unique selling propositions
 - Long term customer relationships / growth potential
 - Company perspective
 - Does it fit in the companies strategy?
 - Does it help in realizing the company targets?
 - Product development perspective
 - Can we create added value for the customer?
 - Continuous improvement : “Best way to design & produce”
 - Exploration of new / improved technologies
 - Production perspective
 - Feasibility of current production facilities
 - New requirements – learning curves
 - Suppliers perspectives
 - Profitability
 - Long term relationship
 - Added value

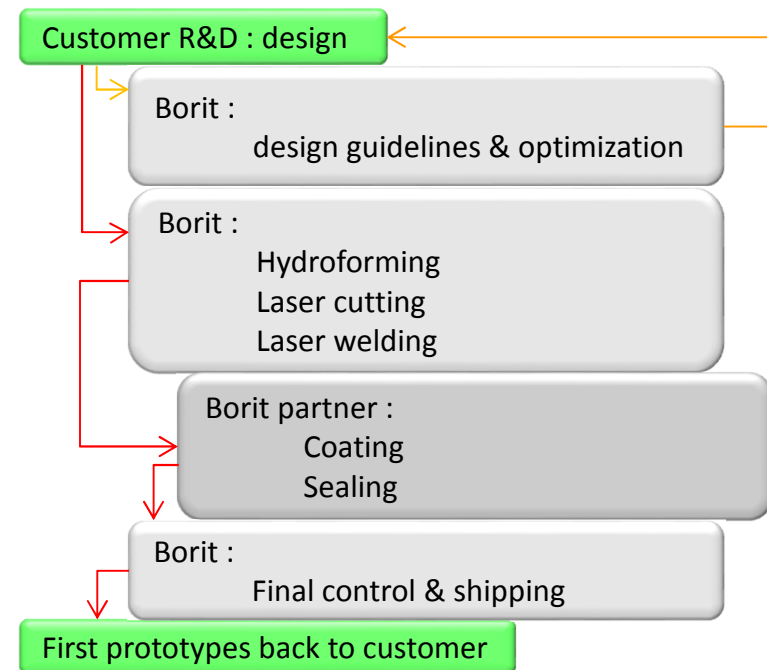
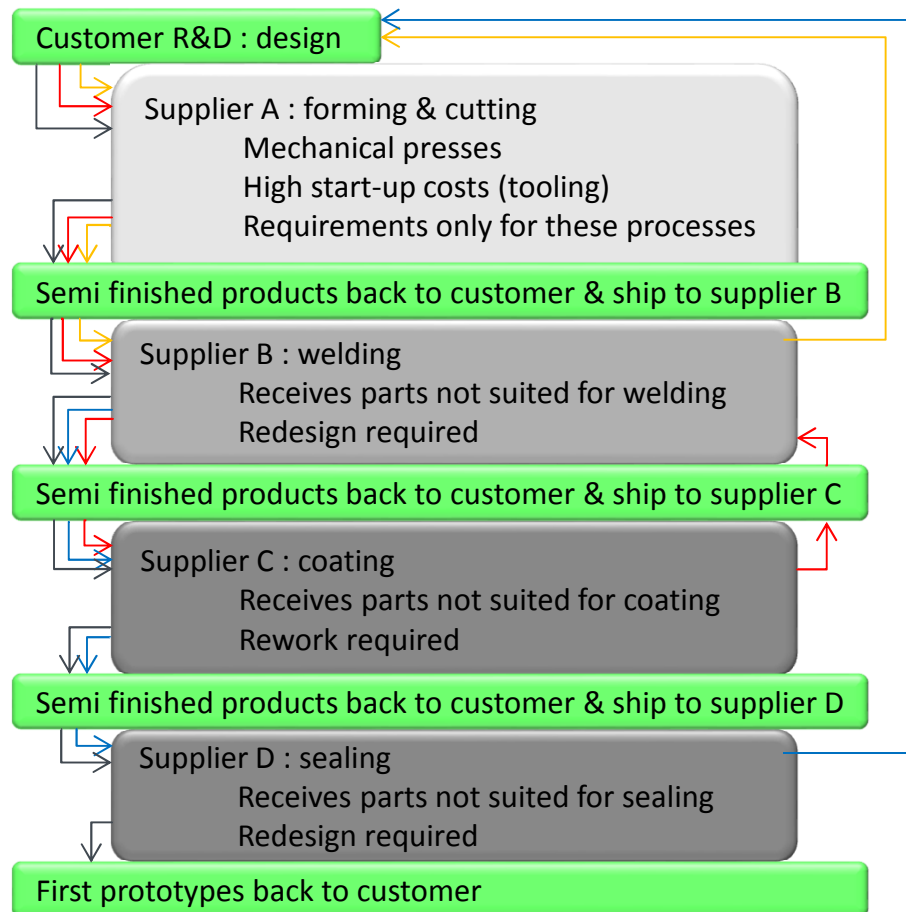


Simultaneous Product & Process development

State of the art

vs

Borit approach



Lots of iterations required
Time consuming – customer has to manage
Expensive
Frustrating

“One stop shop” for the customer – Borit manages
Less iterations required, all before production
Faster
Cheaper

Flexibility | Quality | Productivity



Questions ?

Borit NV

Lammerdries 18d

2440 Geel

Belgium

contact@borit.be

T +32 14 25 09 00

F +32 14 25 09 09

Borit Inc

1768 East 25th Street

Cleveland, OH 44114

USA

contact@borit.us

T +1 216 881 8291

F +1 216 274 9254

Borit NV

Level 10, TOC Minato Mirai,

1-1-7 Sakuragi-cho, Naka-ku,

Yokohama, Kanagawa 231-0062

Japan

contact@borit.asia

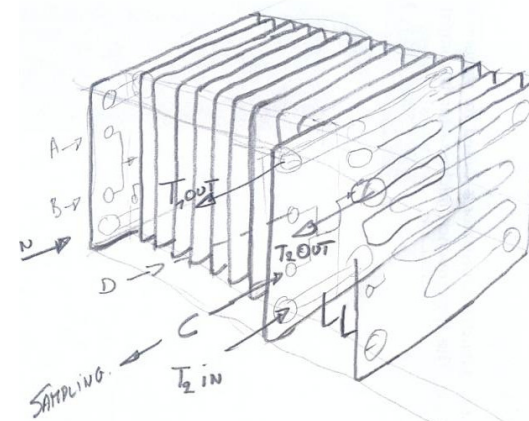
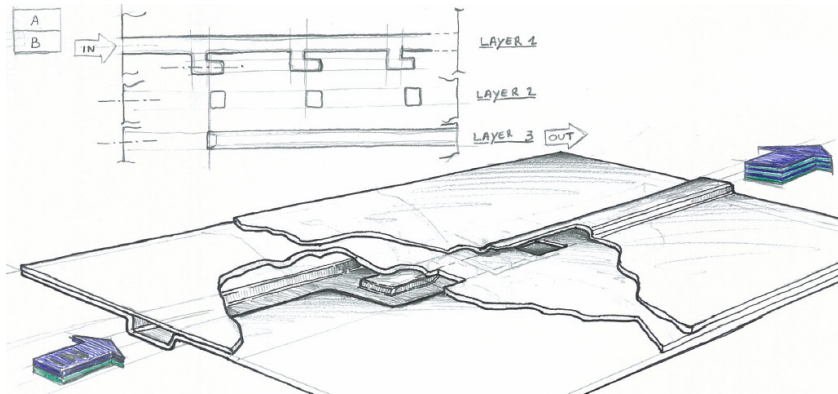
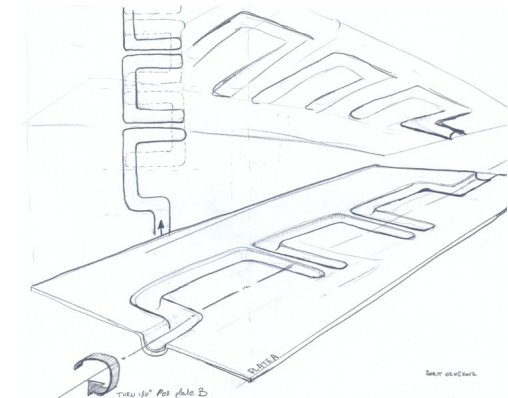
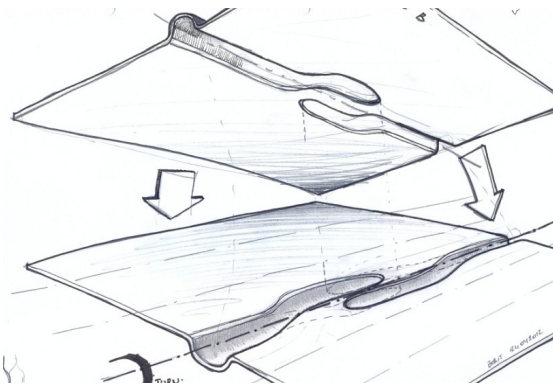
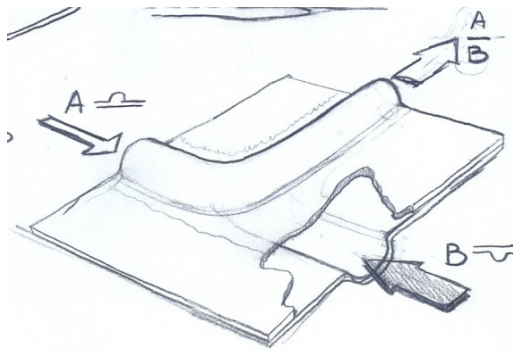
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Back-up slides

Engineering

3D design

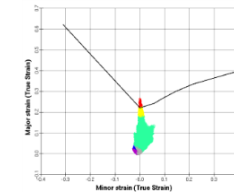
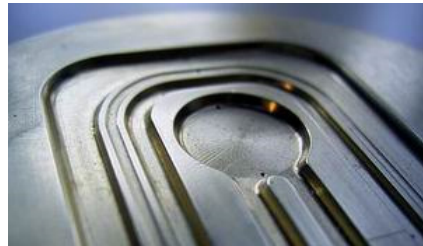
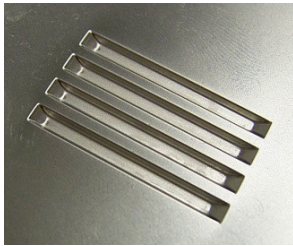
- Translate customer requirements into 3D design
- From concept study to detailed technical design



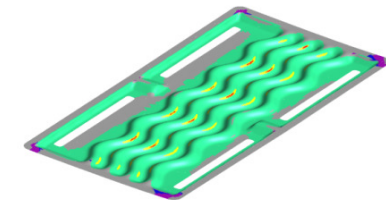
Engineering

Product feasibility, optimization & simulation

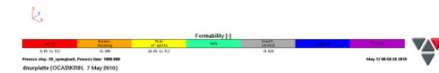
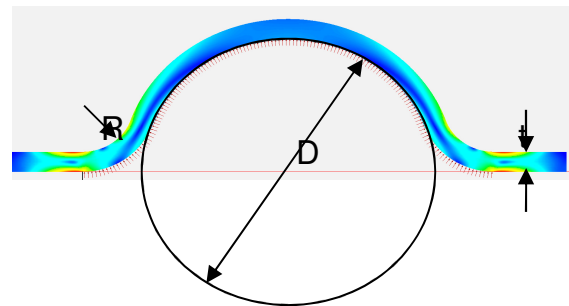
- Pragmatic small scale forming tests



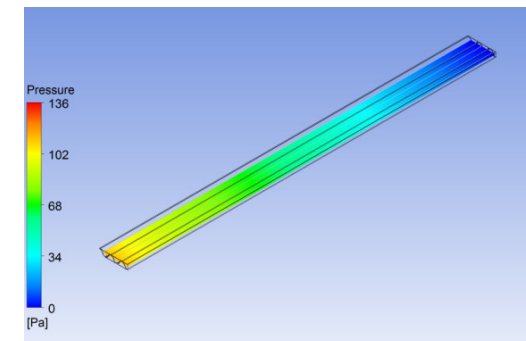
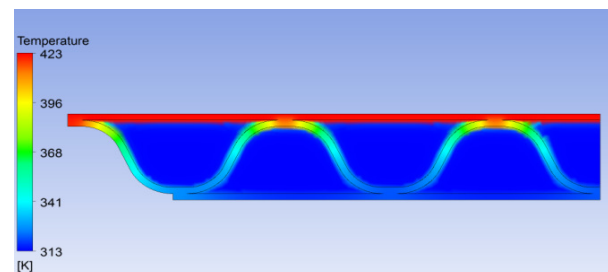
- Forming simulations



- Finite element calculations



- CFD (fluid dynamics) calculations (with external partners)



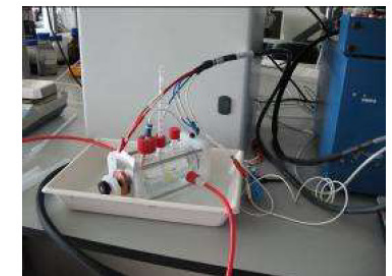
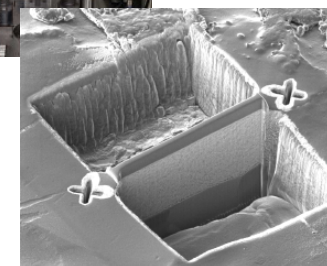
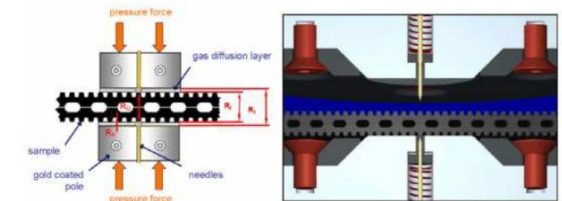
Material

Materials @ Borit

<u>Grade</u>	<u>Thickness (mm)</u>	<u>Max elongation (%)</u>
• Austenitic stainless steel (304L, 316L, 904L, 310S, ...)	0,05 – 1,0	40 % - 52%
• Ferritic stainless steel (430, 441, 444, specialty, ...)	0,1 – 1,0	15% - 30%
• Nickel based alloys (200/201, 286, 600, 625, ...)	0,1 – 1,0	30% - 50%
• Titaninum (grade 1 & 2, ...)	0,1 – 0,5	20% - 30%
• Aluminum (1000, 3000, ... - series)	0,1 – 1,4	15% - 28%
• Tantalum	0,2	under investigation

Characterization

- Mechanical: tensile test, impact test, ... (at Ocas NV)
- Electrical: resistivity, ... (at Ocas NV)
- Corrosion – ex situ: electro-chemical test, salt spray test, ... (at Ocas NV)
- Chemical: all possible characterization methods (at Ocas NV)



Borit hydroforming

Design flexibility

- More extreme and more complex
- Any metal, any material thickness

Fast and cheap development, from prototyping to series production

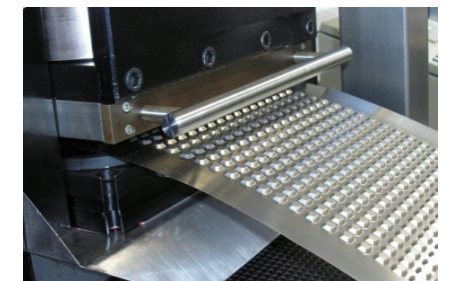
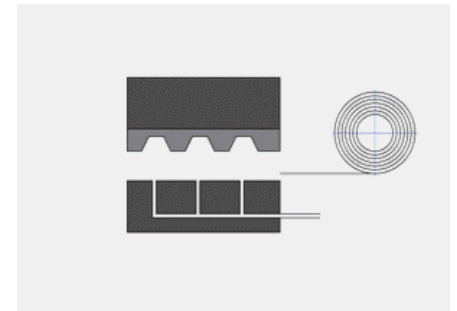
- Pragmatic small scale forming tests
- Simple tooling for prototyping and series production

Quality

- Less residual stresses after forming, more flat plates
- Very high dimensional tolerances and extremely good repeatability
- No material cracks

Productivity

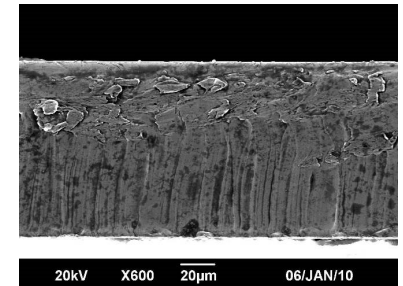
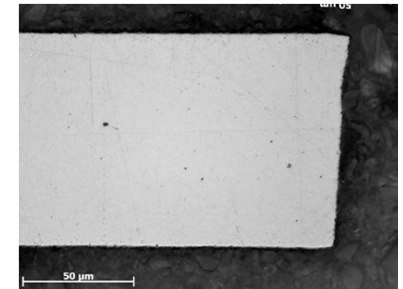
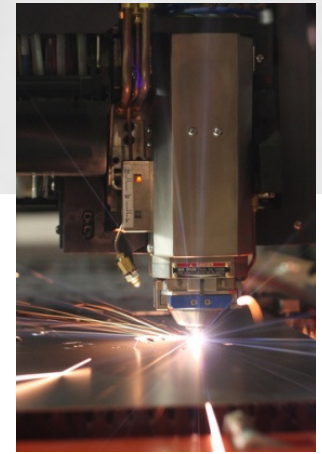
- Continuous production from coil
- Short cycle times
- Multiple parts in one cycle



Laser technology

Laser cutting

- Very flexible cutting technology
- High speed / optimal productivity
- Very tight dimensional tolerances
- Perfect cutting quality for thin materials



Laser welding

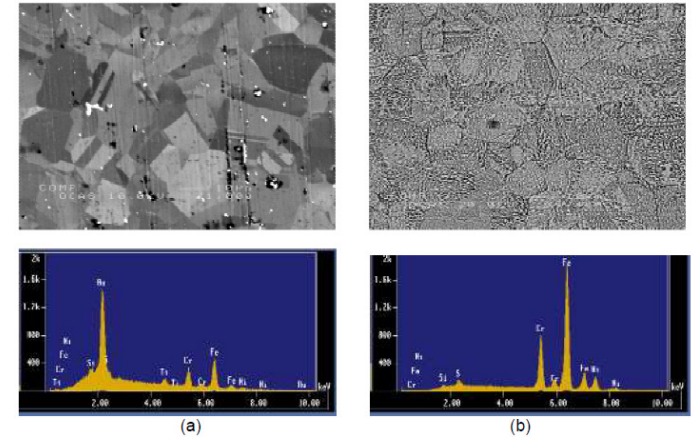
- Operational in house (in 2013)
- Flexible connection techniques
- Perfect welding quality
- Optimal productivity for a high amount of small welds



Other processes

Coating

- External coating partners
- Internal characterization (@ Ocas NV) and performance evaluation
- Possibility for pre- & post-coating



Sealing

- External partners for sealing application
- Different technologies: pre-cut sheets, automated application, on molding, ...



Other connection

- Gluing: thermoplastic systems
- Spot welding
- ...



Fuel cells & electrolyser

Competitive advantage

- More complex and extreme geometries
 - Higher density of channels → higher energy density
 - Improved channel section → lower pressure drop and higher efficiency
- Higher quality parts
 - Improved flatness → more uniform electrical contact, improved stack life & easier assembly
 - Improved mechanical strength and stiffness → allowing for thinner materials / lighter stacks
 - Very tight tolerances → less product performance variation
- Fast and cheap development process
 - Shorter development iterations, lower investment risk for the customers, faster feed back on product performance, faster market entry, ...
- Highly productive manufacturing process
 - Flawless transition from prototyping to large series

Track record

- Global portfolio of 25 paying customers
- Automotive, aviation, residential, back up power, consumer electronics and fork lifts ...

