

# Precision Sealing & Material Solutions for Hydrogen



 **Hydrogen Tech** Conference 2024  
World

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   [omniseal-solutions.com](https://www.omniseal-solutions.com)

# CONTACT US



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**Omniseal Solutions**  
SAINT-GOBAIN

# A Strong Global Group

**MAKING  
THE  
WORLD  
A BETTER  
HOME**



Commitment to achieve **carbon neutrality in 2050**



**World or European leader** in most of our businesses

Founded over

**350**

years ago

Locations in

**76**

countries

Saint-Gobain Research

**8**

cross-business R&D centers

Innovation Efforts

**3,600**

researches

**+400**

patents filed each year

More than

**160,000**

employees

Approximately

**900**

manufacturing facilities around the world

2023 Financial Results

**€47.9bn**  
Sales

**€5.3bn**  
Operating income

**€3.2bn**  
Recurring net income<sup>(1)</sup>



Capital expenditure

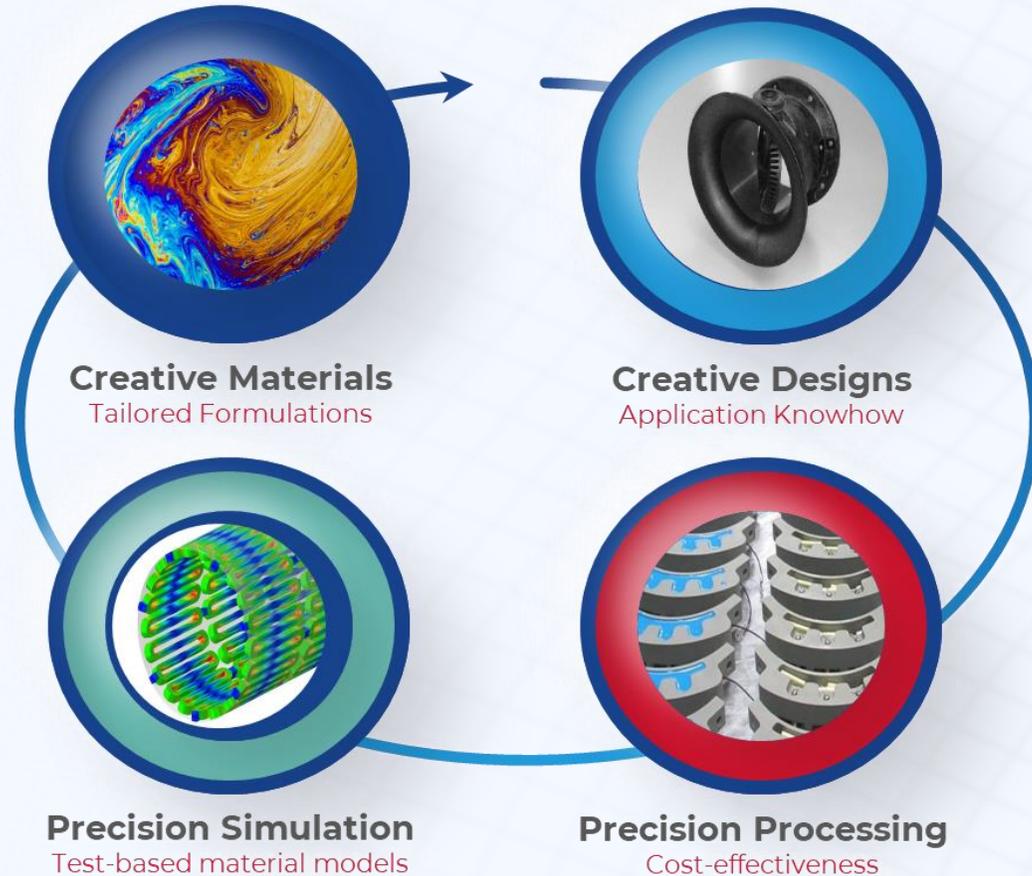
**€2.0bn**

Free cash flow

**€3.9bn**



# Unique & unmatched custom engineered solutions from material to final product



## Our unique approach for problem solving



Experienced, problem-solving engineers that create collaborative partnerships with customers



Partnership with test labs to assess material properties



From analysis to application testing, our R&D teams support all testing efforts

# Our precision sealing and material solutions

Our customers rely on the **passion, expertise** and **diversity** of our High Performance Solutions teams to overcome their toughest challenges. They value our **unique, safe** and **innovative** solutions, enhanced by digital technologies and customized services.

Unique **materials** expertise + Power of **innovation** + **Global** footprint

**TOGETHER, WE ENGINEER A BETTER, SAFER AND GREENER WORLD.**

Beyond the boundaries of  
**POSSIBLE**



OMNISEAL® SPRING-ENERGIZED SEALS



OMNISEAL® ROTARY LIP SEALS



OMNISEAL® METAL SEALS



RULON® FLUOROPOLYMERS



MELDIN® HT THERMOPLASTICS & POLYIMIDE

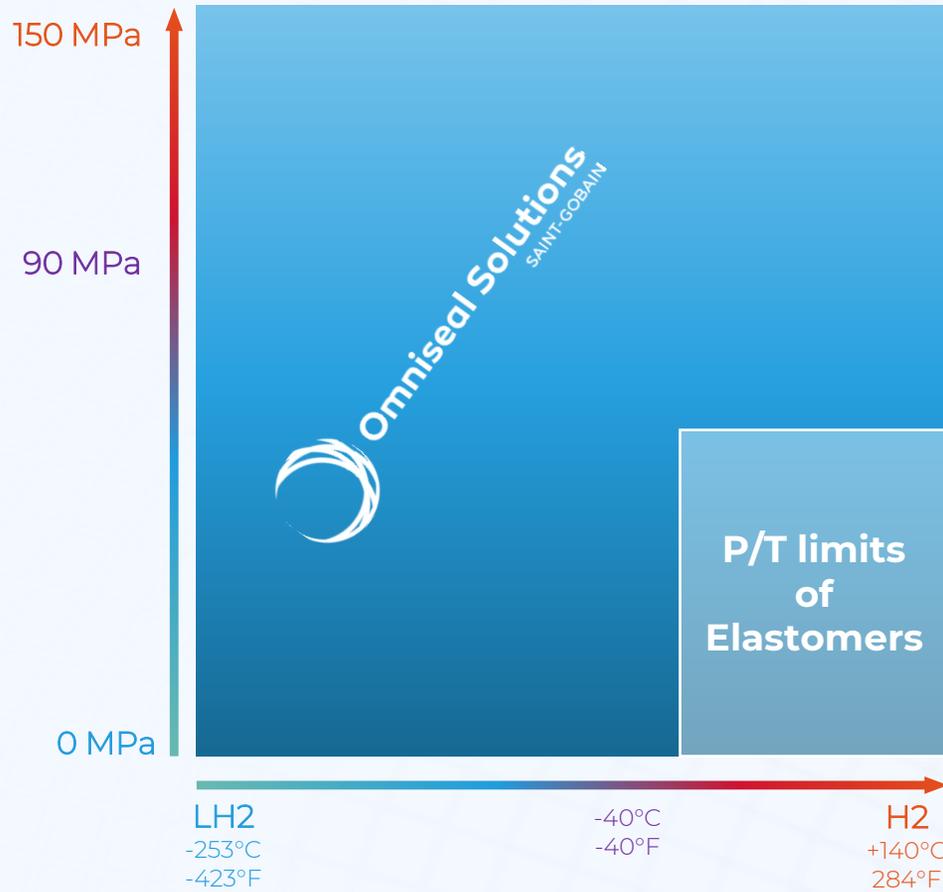


HYCOMP® COMPOSITES



PFAS-Free Alternatives

# Our Unique & Unmatched custom solutions for high performance Sealing & Wear components in Hydrogen



## OMNISEAL® POLYMER SEALS



- Not affected by RGD
- Controlled friction
- Low heat generation
- Wide P/T range from Cryo up to +100MPa

## OMNISEAL® METAL SEALS



- H2 compliant materials
- Not affected by RGD
- Extreme low leakage
- Chemical inertness
- From Cryo up to +100MPa

## RULON® FLUOROPOLYMERS



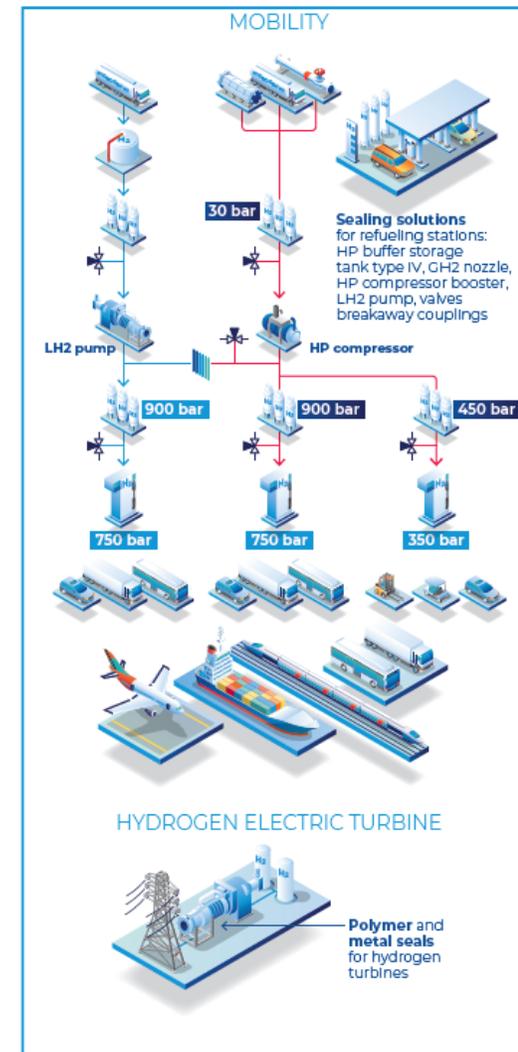
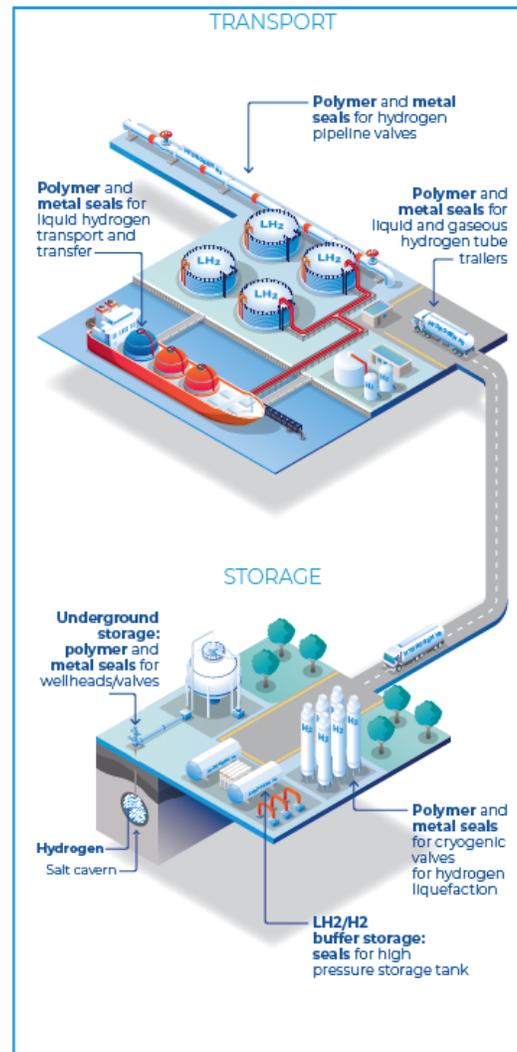
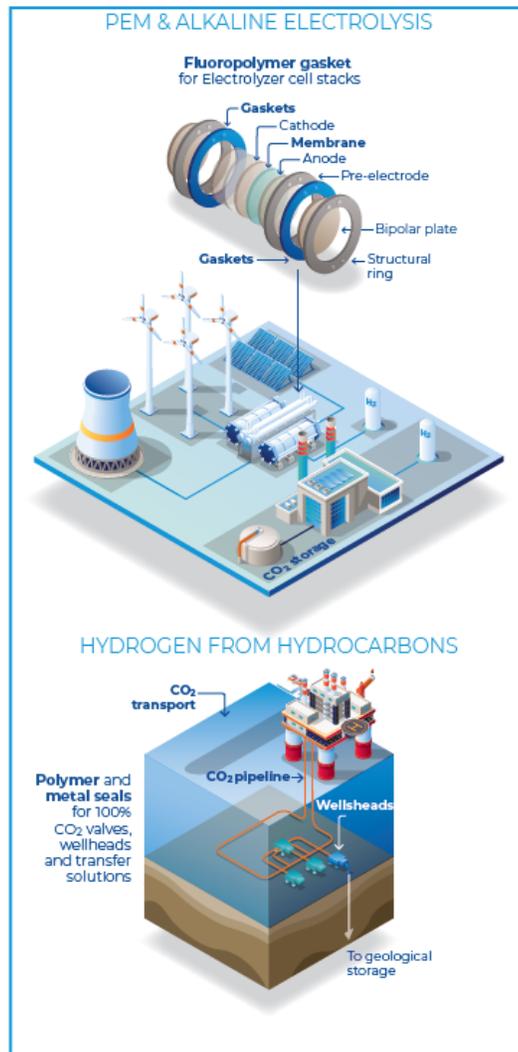
- Dimensional stability
- Creep resistance
- Low heat generation
- Chemical resistance to KOH solutions

## MELDIN® THERMOPLASTICS



- Excellent tribologic performance in H2/LH2
- Low heat generation
- Able to cope with extreme pressure

# Our Solutions for the Hydrogen market



# Global Technical leadership

One Global Team...



with core competences...



Advanced  
Simulation &  
Data  
Engineering



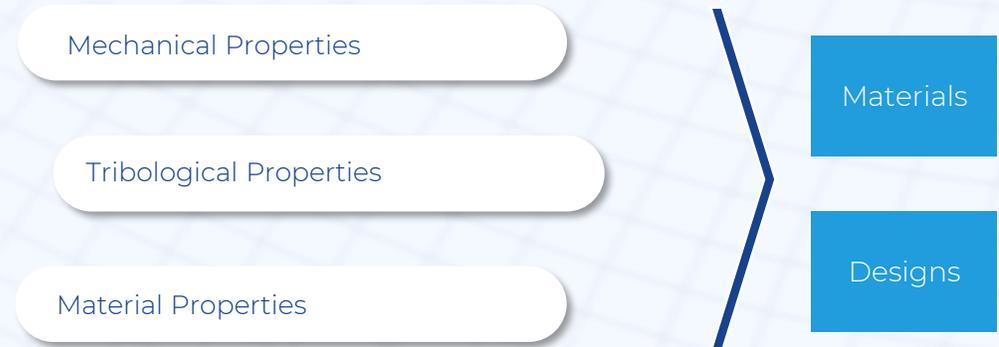
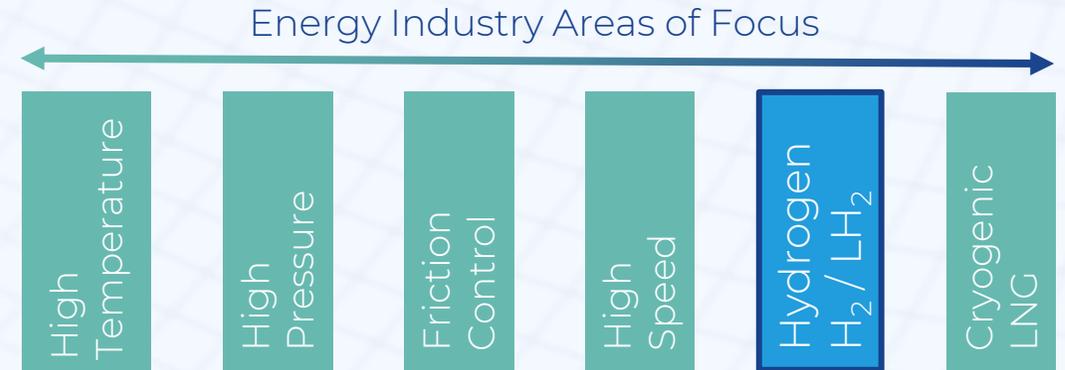
Rapid  
Prototyping



In House  
Testing



Material  
Science



# Evaluation of Hydrogen Compatibility through External Material Testing Campaigns

WE PARTNER WITH EXTERNAL TEST LABS TO GENERATE DATA ON MOST CRITICAL MATERIAL PROPERTIES

Most of tests in Industry do not utilize Hydrogen as a test media, or even no Technical Specification exist yet



OMNISEAL® SPRING-ENERGIZED SEALS



OMNISEAL® METAL SEALS

Aging in high pressure H2

RGD in high pressure H2

Thermal behavior in high pressure H2

Mechanical Properties in high pressure H2

Permeation in high pressure H2

Tribological Properties in high pressure H2

Aging in high pressure H2

Fatigue in high H2 pressures (<1500 bar) & temperatures (-253°C to +600°C)

Lifetime assessment in extreme H2 conditions

Mechanical Properties in H2/LH2

Material Characterization after H2 exposure

## Application-based Testing

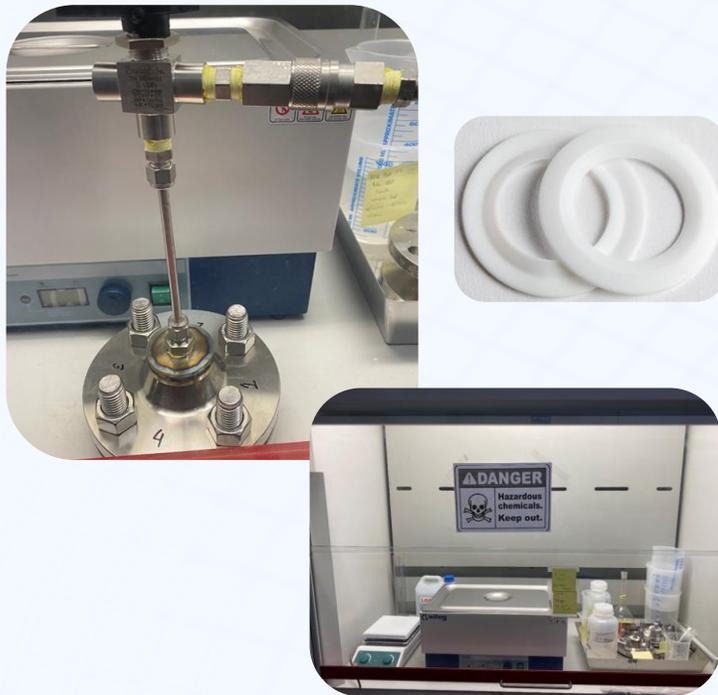
- ALK / PEM electrolyzers
- H2 / LH2 valves
- H2 Compressors
- H2/LH2 refueling solutions
- LH2 reciprocating pumps



# Our internal material characterization capabilities for Gaskets in Electrolyzers

## KOH CHEMICAL COMPATIBILITY

30 bar | 85°C | 30% KOH



## LEAKAGE (RT / 70°C)

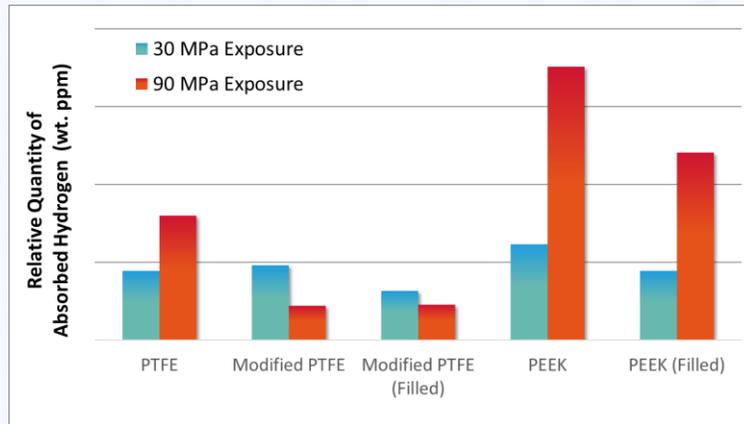


## COMPRESSION & CREEP



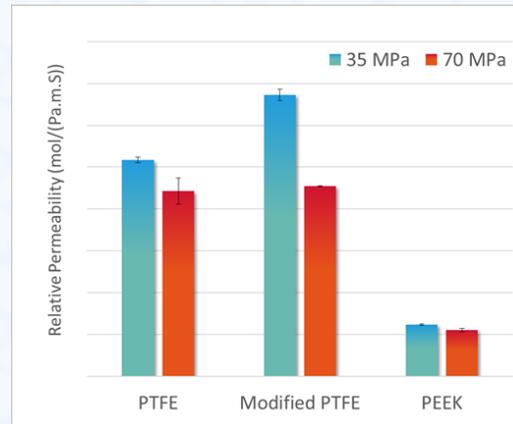
# Our H2/LH2 material testing campaign for Transport-Storage and HRS equipment

## ABSORPTION



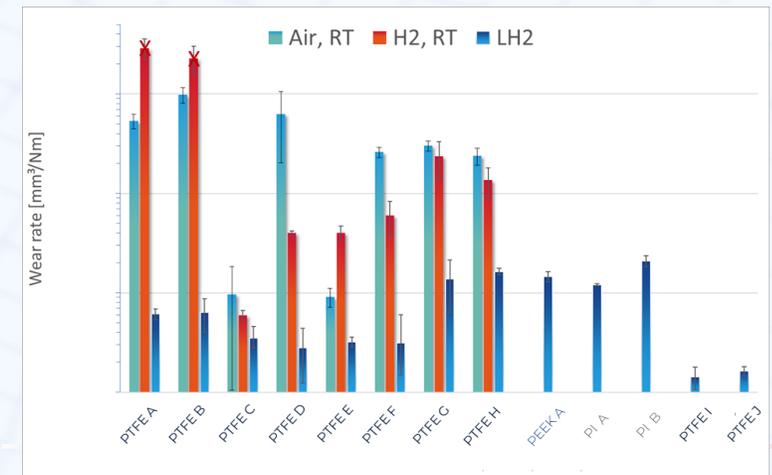
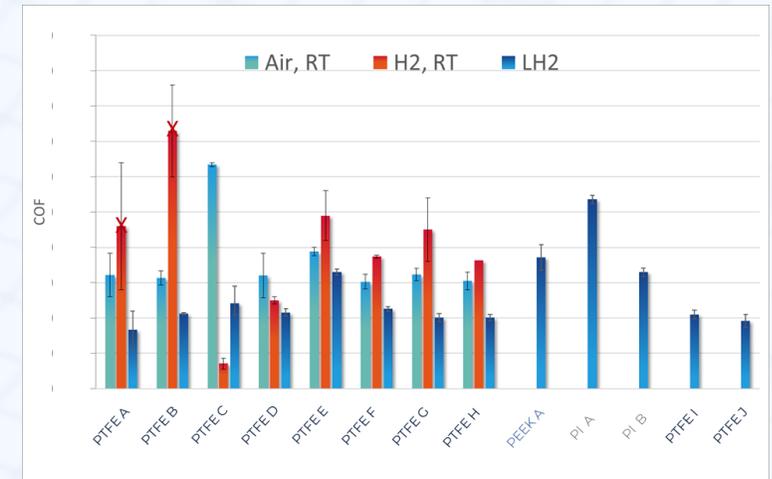
- PEEK absorbs a higher content of hydrogen, compared to PTFE or modified PTFE.
- At higher pressure, hydrogen uptake of modified PTFE decreases, as opposed to PTFE or PEEK, and is lower than PTFE.
- With addition of appropriate fillers, the overall hydrogen uptake can be decreased, which could be more significant at higher pressure.

## PERMEATION

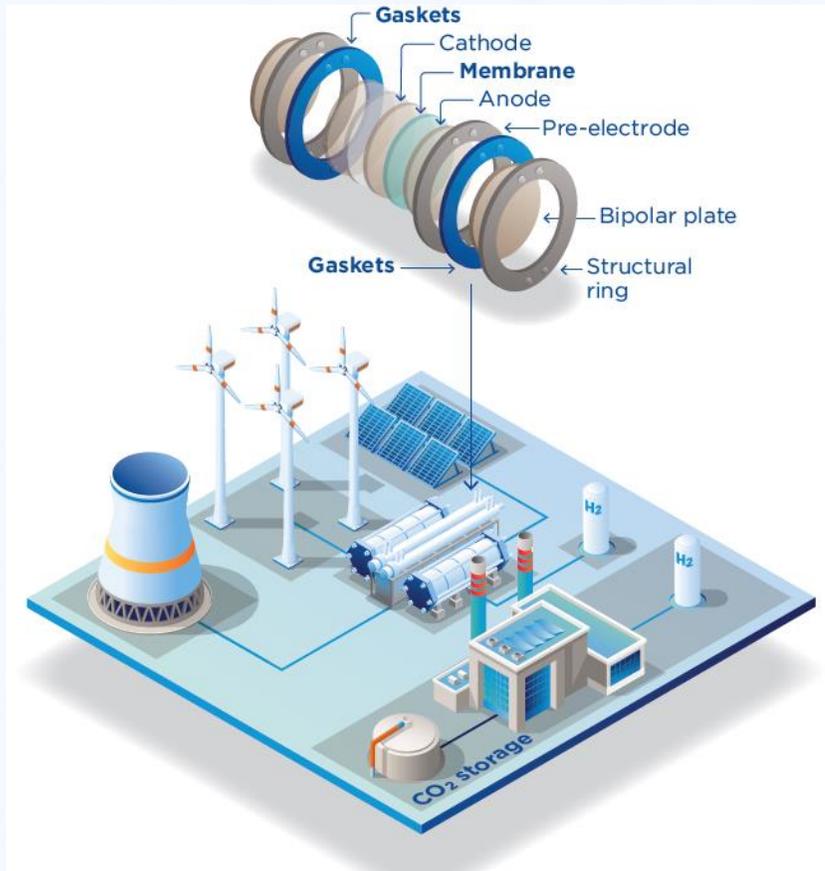


- PEEK has lower hydrogen permeability compared to PTFE or modified PTFE
- At 30 MPa, the modified PTFE showed higher permeation to hydrogen, compared to PTFE.
- A higher permeability tends to favor the resistance to RGD. However, mechanical and thermo-mechanical properties should be also considered to better evaluate the final performance.

## TRIBOLOGY



# Large diameter Rulon® fluoropolymer gasket for pressurized Alkaline Water Electrolyzers

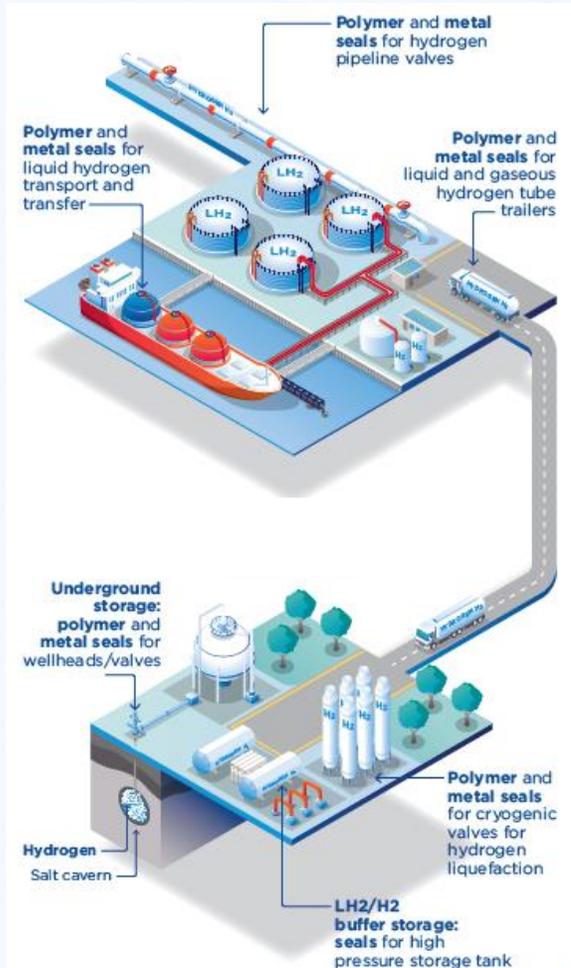


WE HAVE DEVELOPED PRECISION AND COST-EFFECTIVE MANUFACTURING CAPABILITIES THAT ALLOW US TO SUPPLY ONE SINGLE PIECE GASKETS LARGER THAN ANY SHEETS SIZE



- Material characterization according to EN13555
- Proven tightness performance with Helium
- Chemical compatibility with Hydrogen, Oxygen, KOH solutions
- No weld, Long life
- Manufacturing optimization by reduction of waste material
- Up to 3.0 meters<sup>(\*)</sup> max for circular or rectangular shaped gasket

# Omniseal<sup>®</sup> polymer & metal seals for transport, transfer and storage of Hydrogen



- ### Our Value Proposition
- Long track-proven experience with gas and liquefied gas
  - Numerical thermo-mechanical simulation
  - Material characterization (permeation, RGD)

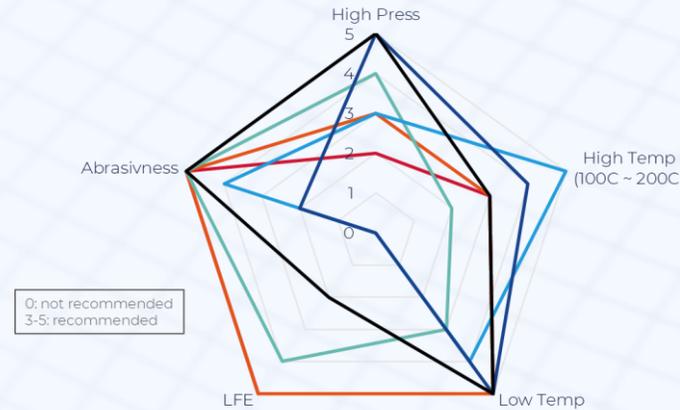
- ### Normative Landscape
- 
- API SC21 WG#3 for Polymers in H<sub>2</sub> Service
  - API 6D Annex M – Hydrogen Pipeline Valves
  - CEN/TC69/ WG 19 - Valves for hydrogen applications and networks



OMNISEAL<sup>®</sup> SPRING-ENERGIZED SEALS



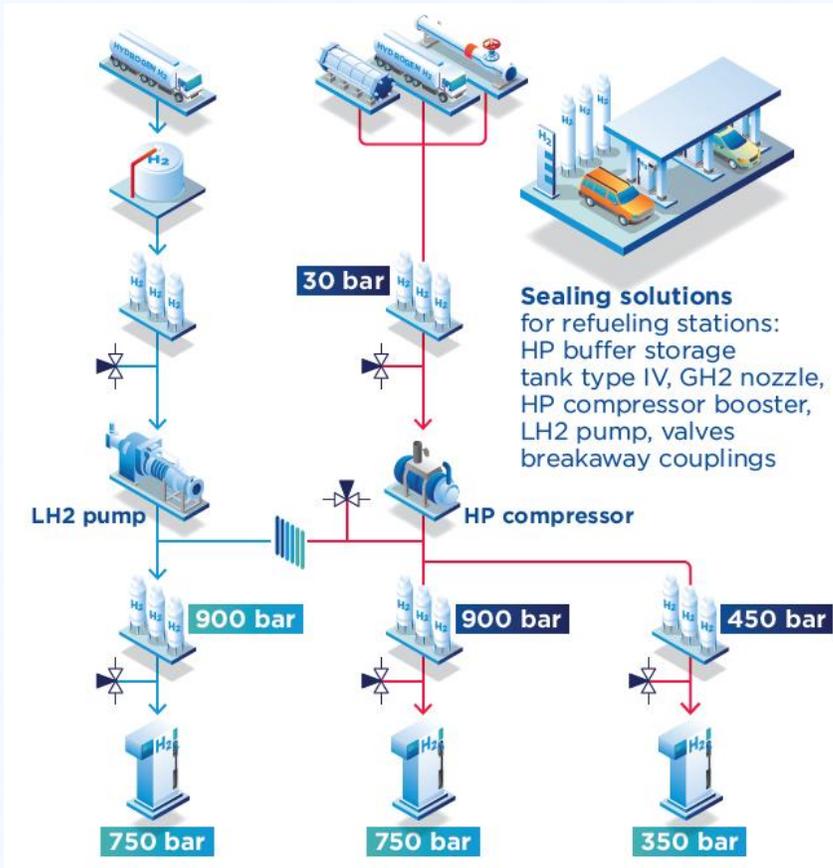
— A01 — A02 — A28 PFAS Free — A08 — A41 — Meldin 5301 PFAS Free



Omniseal Solutions <sup>™</sup> proprietary materials	Seat Seals	Stem Seals	Static Seals	PFAS Free
Fluoroloy <sup>®</sup> A01	2	2	3	
Fluoroloy <sup>®</sup> A02	3	3	3	
Fluoroloy <sup>®</sup> A28	2	2	2	X
Fluoroloy <sup>®</sup> A08	1	2	3	
Fluoroloy <sup>®</sup> A41	1	3	1	
Meldin <sup>®</sup> 5301	2	1	2	X

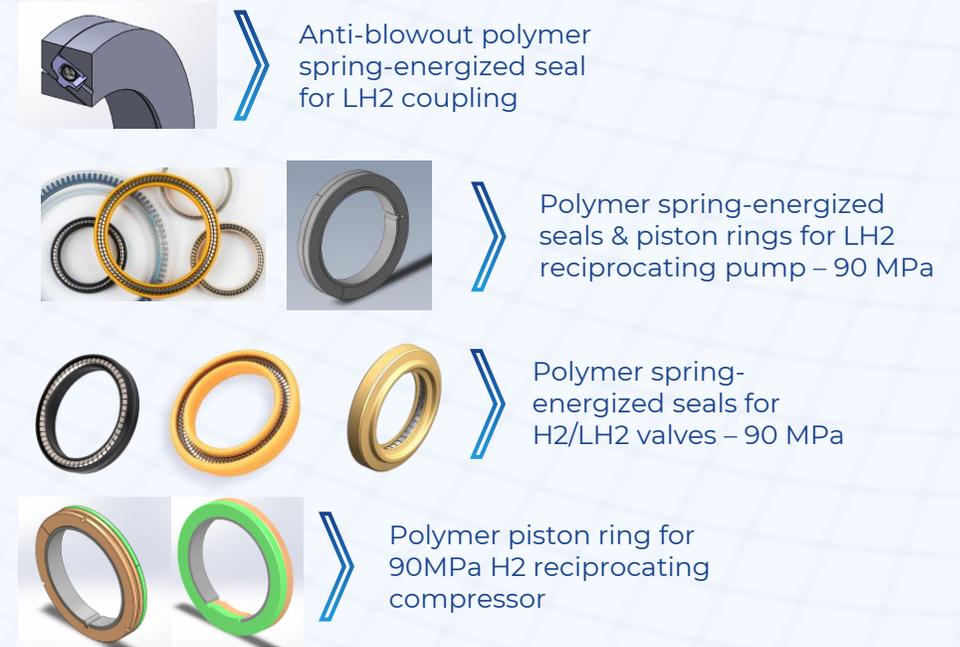
# Engineered Omniseal<sup>®</sup> polymer & metal seals for the stringest operating conditions in HRS

## CUSTOMIZED OMNISEAL<sup>®</sup> POLYMER SEALS



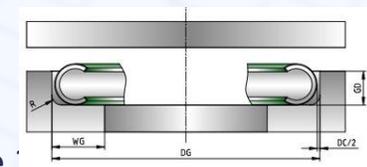
### Our Value Proposition

- Expertise in HP and Cryogenic applications
- Numerical thermo-mechanical simulation
- Material characterization H2/LH2 tribo
- Large choice of polymer materials (PTFE, PEEK, PAI, PI) and H2 compliant metals



- Anti-blowout polymer spring-energized seal for LH2 coupling
- Polymer spring-energized seals & piston rings for LH2 reciprocating pump – 90 MPa
- Polymer spring-energized seals for H2/LH2 valves – 90 MPa
- Polymer piston ring for 90MPa H2 reciprocating compressor

## CUSTOMIZED OMNISEAL<sup>®</sup> METAL C- SEALS



Metal C-Seal for high pressure static H2/LH2 applications



Omniseal Solutions  
SAINT-GOBAIN

Thank you!

