HYDROGEN

Hydrogen is an energy carrier with high potential. Surplus energy from renewable energy sources can be used to produce hydrogen via electrolysis and thus store the energy. Hydrogen is also the initial material for Power2X processes. The importance of hydrogen has also been recognised at the state level. Strategy papers and subsidies are intended to ensure that hydrogen establishes itself as an energy carrier on the market.

But hydrogen also brings challenges: Hydrogen is a flammable, explosive gas that is processed under high pressure, depending on the application. Measures for explosion protection, functional safety or the pressure equipment directive are often necessary.

At Labom, we have been dealing with this forward-looking topic for many years and have reliably used measuring instruments specifically for applications in which hydrogen is used.

The unique properties of hydrogen pose a particular challenge.

HYDROGEN FOR ENERGY STORAGE

The variable nature of renewable energy is considered one of the greatest challenges in implementing the energy transition: Solar and wind sources cannot be regulated according to the needs of electricity customers at any given time. The development of workable and economic power storage technologies is therefore a decisive factor for success of the energy transition. Labom is at home both in the equipping of wind turbines in close cooperation with leading manufacturers and in the energy storage segment in terms of metrology. Hydrogen plays a key role in the storage of surplus energy. Surplus energy from renewable energy sources can be used to produce hydrogen via electrolysis in order to store the energy. Hydrogen is also the initial medium for Power2X processes.

Nevertheless, handling the smallest molecule in existence also presents a challenge: Hydrogen dissolves in numerous metals and is so small that it penetrates stainless steels and causes some types of steel to become brittle.

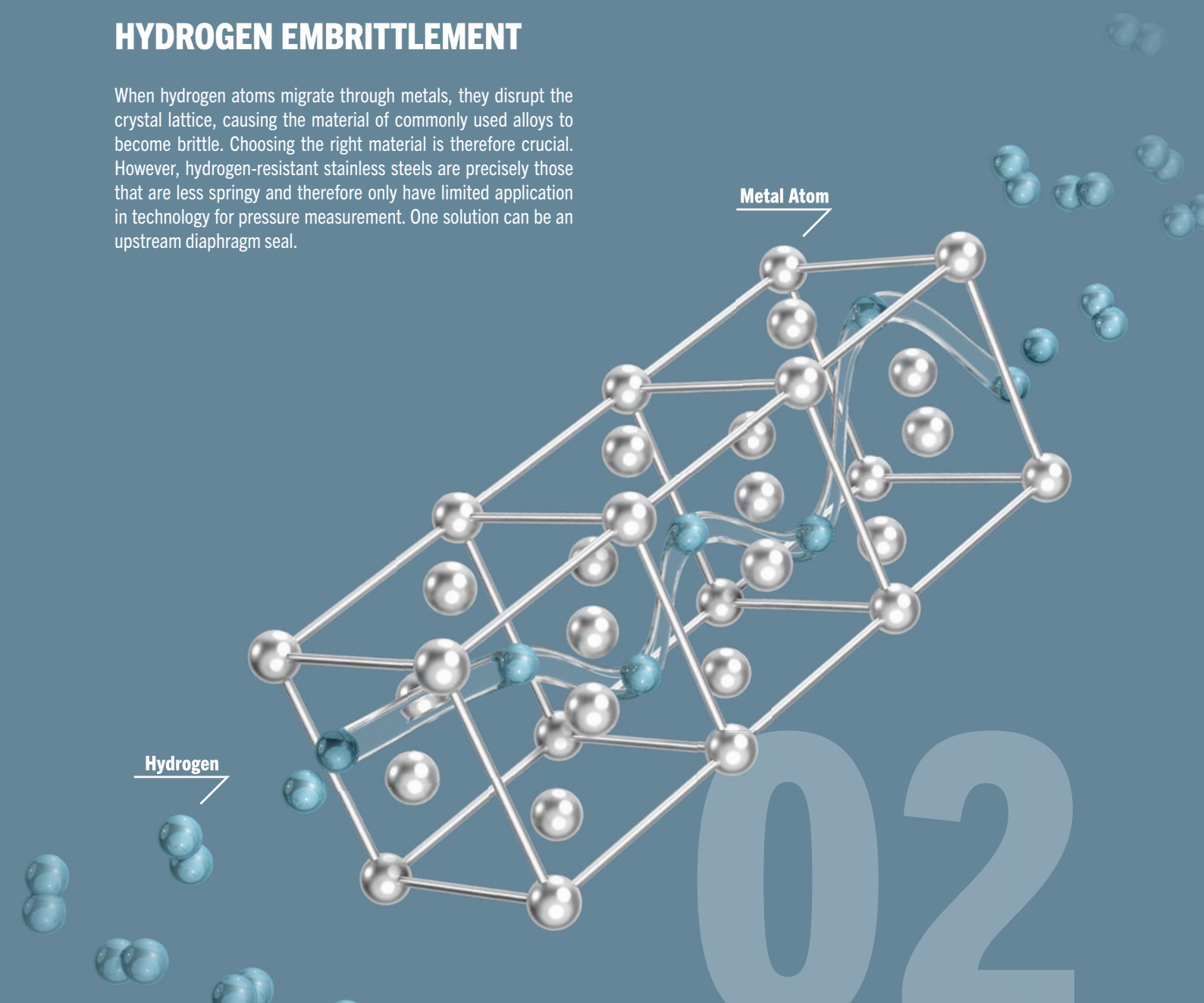
HYDROGEN EMBRITTLEMENT

When hydrogen atoms migrate through metals, they disrupt the crystal lattice, causing the material of commonly used alloys to become brittle. Choosing the right material is therefore crucial. However, hydrogen-resistant stainless steels are precisely those that are less springy and therefore only have limited application in technology for pressure measurement. One solution can be an upstream diaphragm seal.

HYDROGEN PERMEATION THROUGH STAINLESS STEEL

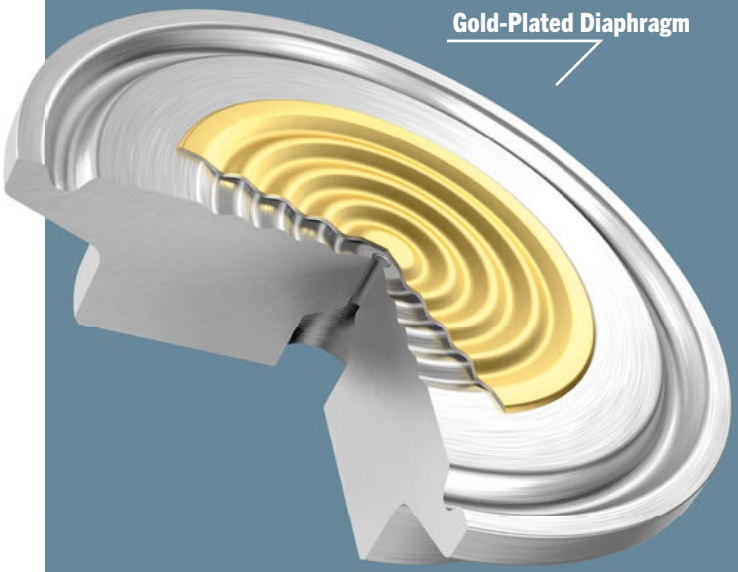
The hydrogen molecule decomposes into hydrogen atoms on the surface of metals and these can diffuse through metals: First the hydrogen molecules decompose into atoms, then the atoms migrate through the tetrahedral and octahedral gaps of the metal lattice and reunite as molecules on the other side. The whole process is called permeation (see illustration).

The rate of permeation depends on the temperature, pressure and material.



RELEVANCE FOR PRESSURE METROLOGY

Diaphragm seals have a thin metal diaphragm on the process side. The pressure is transmitted to the sensor via the diaphragm and a filling liquid, usually oil. If hydrogen penetrates the membrane, it dissolves in the oil. Once saturation is reached, the hydrogen forms beads as the pressure is relieved and this leads to measurement errors such as shifting the zero point.



SOLUTION

Depending on the process conditions, a diaphragm seal with a membrane made of hydrogen-resistant stainless steel, or a gold-plated membrane can be used.

We have scientifically investigated the effect of permeation and have developed a tool for calculating the hydrogen permeation and the dissolution of hydrogen in the oil of the diaphragm seal.

To do this, we need information from the plant operator on temperature, pressure and hydrogen content. This is used to calculate how long the service life of the unit would be for different configurations. Among other things, the temperature is decisive for this, since there is a strong temperature dependence - we have therefore also taken this aspect into particular consideration in the calculation formula according to Arrhenius‘ theorem. From the totality of these results, we calculate the service life. We can play with this: Is a stainless steel diaphragm enough to get a service life of ten years, for example? Or do we need a gold coating, and if so, what thickness of the coating makes sense?

With our calculation tool for hydrogen applications, we can offer our customers the most cost-effective and technically suitable solution.

Labom Serie PASCAL Ci4

The ultimate in measuring accuracy, intuitive and convenient operation, suitable for hydrogen applications

Labom Serie PASCAL CV4

Compact design, intuitive and convenient operation, suitable for hydrogen applications

Labom Serie PASCAL CV3

Smart modular technology for displaying, switching and communicating, suitable for hydrogen applications

Labom COMPACT HYDROGEN

Digital pressure measurement, very good resistance and high long-term stability, suitable for hydrogen applications

Labom Serie COMPACT

Sturdy design for use under difficult conditions, for use in hydrogen refueling stations

Labom diaphragm seals

Diaphragm seal for agressive and highly viscous media - gold coated for hydrogen applications

Labom PASCAL Ci4 Delta P

Differential pressure measurement, even at high static operating pressures, suitable for hydrogen applications

Your reliable partner for hydrogen projects.

You can also find all information about hydrogen on our website: www.labom.com

HYDROGEN APPLICATIONS
UP TO 1050 BAR

Labom
Mess- und Regeltechnik GmbH

Im Gewerbepark 13
27798 Hude
Germany

Telefon +49 4408 804-0
Fax +49 4408 804-100
info@labom.com
www.labom.com

Labom