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MESSER
Gases for Life

Gases for Life

The industrial gases magazine

Gases for analysis:
Reliable values

Tanker construction:
Securely welded

Steel machining:
Harder through cooling

Insulating materials:
Positive overall effect

Dear Readers,

Air is very much our theme these days – in many respects. The "Big Air Package" exhibition in the Oberhausen Gasometer recently opened its doors. Christo, the famous wrapping artist, has created the world's largest indoor sculpture in the former gas storage tank. Messer is sponsoring the Christo exhibition.

Protection of the air we breathe is an important consideration in the use of zero-grade and calibration gases. When carrying out emissions tests and calibrating measuring instruments, high-purity gases and gas mixtures provide reliable reference values. In the area of gas chromatography, nitrogen is used as a carrier gas for the sample to be analysed. You can find out more about this in our cover story, "Reliable values".

Of course, air is also the raw material from which we obtain our "Gases for Life". Exactly how this works is explained in the GaseWiki section of this issue.

I hope you enjoy reading this issue and wish you a lovely spring with the opportunity to spend lots of time in the fresh air.

Best wishes,

Stefan Messer

Cover Story

Zero-grade and calibration gases are indispensable when exact reference values are required. This applies to everyday applications such as car exhaust analysis, but also to more sophisticated analytical processes such as analysing the concentrations of harmful substances in the air we breathe. Gas chromatography, which can detect individual chemical compounds in a sample, also relies on high-purity gases.

Cover photo: Renáta Simonics, Sales Manager for Specialty Gases at Messer in Hungary, with a small sample of wine for analysis at the Egerfood Knowledge Centre.

Practical Focus

Safety is of paramount importance when transporting gases, mineral oil or fuels. In order to ensure maximum safety, materials of particularly high quality are used to build the trailers and containers for the tankers. The use of appropriate welding and cutting gases and the right welding techniques, also have a crucial bearing on their quality.

Using Gases

For steel used in high-stress applications, such as saw blades, cryogenic nitrogen is required to give the metal extra hardness. It freezes the steel during processing, changing its microstructure. Messer supplies both the technology and the nitrogen for this process.

Good for you and the environment

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Other Sections

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Spain: Diving gases

Diving gases from Messer are also being used in the exploration of the wreck of the "Amiral de Kersaint".

Gas mixtures for diving

Oxygen, and other gases, are essential for diving. Different mixtures are needed depending on the depth and duration of the dive, and many divers blend their own mixtures. Increasingly, however, ready-made mixtures consisting of oxygen and nitrogen, or of helium, oxygen and nitrogen, are being used. The degree of purity of the diving gases must correspond to that of medical gases. Messer is one of the leading suppliers in Spain and is working with the Catalan Society for Underwater Research, among others. With almost 5,000 kilometres of coastline, Spain attracts a large number of amateur and professional divers. For example, there are around 800 diving schools and numerous companies that specialise in activities such as laying pipelines in reservoirs as well as welding and repair work on underwater tanks, in harbours and on oil platforms.

Marion Riedel, Messer Ibérica de Gases

Bosnia-Herzegovina: Waste water treatment with CO_2

Thousands of tonnes of waste water neutralised

Large quantities of waste water from the ArcelorMittal steelworks in Zenica are neutralised by means of carbon dioxide. Pure CO_2 is injected into the pipes which carry many thousands of tonnes of waste water to three sedimentation tanks. The system installed by Messer lowers the pH value from 12 or 13 – i.e. a strong alkali – to 6 or 7, a value which corresponds to that of mineral water. This means that the treated waste water can be safely discharged into the River Bosna without affecting the river's pH value. The carbon dioxide for this comes from the newly built plant in Sockovac.

Maja Softic, Messer Tehnoplin

Turkey: Liquid gases for automotive supplier

Proven partnership with Donghee

The manufacture of metal vehicle parts involves a lot of welding. Donghee, the Korean manufacturer of axles and other components for the automotive industry, is currently building a new production site in the Turkish town of Hendek. The partnership between Messer and Donghee, already established in the Czech Republic and Slovakia, is now being extended to the new site. Messer in Turkey will supply Donghee with the shielding gases argon and liquid carbon dioxide. Messer will also provide the equipment for on-site production of Ferroline mixtures for steel or iron welding.

Haluk Tunçer, Messer Aligaz Sanayi Gazlari

Austria: Nitrogen combats rust and risk of explosion

Pipeline purged with nitrogen

A pipeline stretching 150 kilometres through Lower Austria is currently being laid as part of the biggest pipeline project in the history of Austrian energy supplier EVN. The new high-pressure natural gas pipeline is due to be completed at the end of

A 70-kilometre section of high-pressure natural gas pipeline was purged with 2,000 cubic metres of nitrogen per hour.

2013, after which it will ensure that customers are supplied until 2030. As soon as a construction stage is completed, Messer in Austria purges and fills the pipeline with nitrogen until the gas reaches a gauge pressure of 0.5 bars. The nitrogen prevents corrosion of the pipes and reduces the explosion risk during subsequent flooding with natural gas. The section, of approximately 70 kilometres in length, between Gänserndorf and Pischelsdorf was purged with 2,000 cubic metres of nitrogen per hour and preserved until it was put into operation.

Herbert Herzog, Messer Austria

France: Welding gases for giant carousel

Fantastically realistic marine worlds

The fact that the larger-than-life creatures of the "Marine Worlds Carousel" in the French city of Nantes are largely made of metal is not that obvious at first glance. Their fantastic shapes and colours draw the observer into an illusion of a submarine world in which there is no place for metal plates or welding technology. Yet that is exactly what was used to create this marvel of motion. Messer supplied the gases for the welding work. The three-level carousel, 25-metres high, is a moving allegory of life on the surface and in the depths of the oceans. As well as being a unique work of art, it enables visitors to gain technical and scientific know-how. Moreover, it symbolises the history of the port city, which is also the birthplace of Jules Verne. Could that be a coincidence?

Angélique Renier, Messer France

Italy: Metallisation of plastic

Glossy finish using vapour

Vacuum coating is an efficient method for giving plastic components – for example sanitary fittings or costume jewellery – a metallic surface. To ensure perfect quality, nitrogen is used in the process. First, though, the metal is vaporised in a vacuum chamber and sprayed onto the plastic. Thus, with minimal consumption of metal, an even surface is achieved, although initially it is still very sensitive. This is where the nitrogen comes into play. It forms a protective atmosphere, preventing oxidation and contamination by airborne dirt particles until the coating has hardened. An Italian coating specialist has built a new plant near Mantua, which is due to go into operation soon. Messer in Italy has installed a nitrogen tank there and will be supplying the gas for it.

Lorena Vaschetto and Antonio Ferrentino, Messer Italia

Slovakia: Nitrogen generator for oil refinery

Outstanding achievement

Over a period of 15 years, the Slovnaft refinery in Bratislava will be supplied with at least 6,000 cubic metres of nitrogen per hour from a new nitrogen generator which went into operation in September 2012. Slovnaft requires the nitrogen for various processes in its oil processing operations. The generator was installed by Messer and is operated by a joint venture set up by the two companies. It has a secondary supply system in order to guarantee a reliable round-the-clock supply 365 days a year. The facility was built in a very short space of time. It more than meets all the requirements regarding quality and its specific power consumption is well below the stipulated value.

Helge Kreiker, Messer Slovnaft

Securely welded

When transporting goods such as gases, mineral oil or fuels, safety is of paramount importance. State-of-the-art tankers and dry bulk container trucks ensure that the load is securely and reliably transported from A to B. In order to ensure maximum safety, materials of particularly high quality, toughness and strength are used to build the trailers and containers for the vehicles. But it is not just the materials that matter when it comes to the construction of these containers – the welding techniques with which the individual components are joined and tightly sealed are also crucially important.

Gocher Fahrzeugbau GmbH (GOFA) is one of the world's leading manufacturers of gas, tanker and dry bulk vehicles as well as containers and swap bodies. Messer has had a long-standing reciprocal relationship with the company, which is based in Goch in the district of Kleve (North Rhine-Westphalia): Messer supplies GOFA with welding gases for the manufacture of its vehicles and containers – in turn, Messer uses GOFA tankers to transport the gases.

The vehicle manufacturer has made a name for itself not just on the strength of its high-quality products, but above all through its flexibility in responding to the individual requirements of customers and making exactly the right vehicle for each of them. "These custom-built products in particular require a lot of technical know-how, ranging from the choice of appropriate materials to expert welding and properly thought-out handling of vehicle superstructure," stresses Dirk Kampffmeyer, Manager Welding and Cutting at Messer.

Vehicles and containers such as the ones used by Messer for transporting gases, liquefied by either temperature or pressure methods, must be able to cope with high pressure and extreme temperatures without any problems. Liquid nitrogen, for example, has a temperature of minus 196 degrees Celsius – cold enough to make some steels as brittle as glass. Tough and high-strength alloys that meet the stringent stability requirements under all conditions are therefore used for manufacture.

Messer advises GOFA on the choice of suitable welding and cutting gases. The company uses standard gases such as nitrogen, oxygen, argon and carbon dioxide (CO_2) as well as special gas mixtures from the Inoxline and Aluline product lines. The Inoxline shielding gases for welding are optimised for joining high-alloy steels and nickel-base alloys while the Aluline mixtures are ideal for processing aluminium and non-ferrous metals

GOFA uses nitrogen, oxygen, argon and carbon dioxide as well as special gas mixtures from the Inoxline and Aluline product lines for welding.

The customer

Gocher Fahrzeugbau GmbH was founded in 1962 and is well-known around the world for building tanker and dry bulk vehicles. At the beginning of the 1980s, the company expanded its product range to include vehicles with containers and swap bodies, and since then GOFA has offered an extensive portfolio of transport vehicles for liquid and gaseous substances. Today the company employs some 130 staff and is a wholly owned subsidiary of Chart Industries based in Garfield Heights (Ohio, USA).

The quality of the weld surface is further enhanced through forming. This process ensures high weld corrosion resistance for gas-sensitive materials such as high-alloy chrome-nickel steels. With forming, the back of the weld and the heat-affected zone also have shielding gases circulated around them during the welding process. This causes all the oxygen-containing ambient air to be displaced, thus preventing oxidation.

Messer also supplies the gases and technology for this process. "We value the high-quality workmanship that GOFA puts into its vehicles and tanks. The fact that we can get both from a single source – and exactly to our requirements – is a further benefit," says Dirk Kampffmeyer. "GOFA in turn is satisfied with our products and above all our service. As the two companies are within only a good hour's drive of each other, we can always quickly pay a personal visit to Goch as and when the need arises." GOFA is supplied with argon, nitrogen, oxygen and CO_2 via permanently installed on-site liquid tanks, while the Inoxline and Aluline welding gases are delivered in cylinders.

Editorial Team

Transporting gases for Messer: truck with a GOFA tank

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Germany: Gases in everyday life

Raising awareness of gases

Gases are as important as water and electricity in almost all manufacturing processes. Yet many end users only have a partial knowledge of how gases are applied. Carbonation of beverages or xenon headlights are among the applications that consumers do associate with industrial gases.

What, though, is a modified atmosphere, used in the packaging of cheese or crisps for example? Is oxygen only used for artificial respiration and why is helium, familiar as a lifting gas for balloons, not simply a plaything?

Gases play an important role in environment and climate protection, whether through the use of oxygen for combustion processes, which saves energy and significantly reduces emissions, or by adding carbonic acid to waste water as part of the treatment process, for instance. Messer has launched a publicity campaign aimed at raising public awareness of the properties of gases and their applications. This includes offering information material for schools. One very visible manifestation of this campaign was Messer's giant poster on a historic gasometer in the heart of the Ruhr region. For several months, the slogan "We make gases from air" was prominently displayed in huge letters on the famous landmark in Oberhausen. Messer is sponsoring the world's largest indoor sculpture – the "Big Air Package" – which has been created by wrapping artist Christo and will be on show in the Gasometer until the end of the year. Christo uses air to inflate a 90-metre-high walk-in fabric envelope. Messer, for its part, is using this opportunity to focus attention on industrial gases, which make such an important contribution to our everyday lives.

Diana Buss, Messer Group

Germany: Soil freezing with nitrogen

Stability for Berlin's underground

Cryogenic nitrogen is being used to freeze the soil and thus make the excavations for the expansion of the U5 underground line in Berlin secure. The line will run through the historic centre of the German capital from the Brandenburg Gate to the Rotes Rathaus city hall. The construction work on the underground line is being carried out by Bilfinger Construction GmbH. Messer is supplying the equipment and the liquid nitrogen for the freezing projects in two of the capital's most famous streets: Unter den Linden – within sight of the Brandenburg Gate – and Friedrichstrasse.

Dirk Mallok, Messer Industriegase, and Jens Tauchmann, Messer Group

Photo: Phong Phú Home Textile

Vietnam: Carbonic acid for textile production

Carbonic acid replaces sulphuric acid

Cosy, high-quality bath towels are just one of a range of products produced at Vietnam's largest textile factory, Phong Phú Home Textile (PPH). It produces textiles for the home such as cotton towels and bathrobes. Almost half of its output is exported to Japan, Europe and the USA. Environmentally friendly production which conserves resources forms part of the company's philosophy.

One example of how this is achieved is the use of effective state-of-the-art technology in the production of the fabrics. As a large volume of alkaline waste water is generated during production, the company gave careful thought to environmentally compatible treatment solutions. This requires the water to be neutralised with an acid in order to eliminate its corrosiveness. After Messer had carried out successful tests, the method of neutralising the alkaline waste water was converted from one using sulphuric acid to one using carbonic acid (CO_2).

The first step involved dosing the CO_2 directly into the pipe connecting the neutralisation tank and the biological stage of the waste water treatment plant. However, increased production at the factory means that the CO_2 requirement is significantly greater at times. To facilitate efficient injection of this increased quantity of CO_2, Messer has also integrated a tube reactor into the existing waste water main in order to dissolve the CO_2 more effectively by creating turbulence in the water. Carbonic acid is more environmentally friendly, safer and easier to dose than mineral acids such as hydrochloric, sulphuric or nitric acid.

Ivan Perez, Messer Haiphong Industrial Gases, and Dave Phan Thanh Binh, Messer Binh Phuoc Industrial Gases

Photo: Phong Phú Home Textile

People Focus

6 questions for

Sigita Radziukynaité

Sigita Radziukynaité (36) works in the medical gases section at UAB ELME MESSER in Lithuania. She has been a Messer employee since May 2006 and lives in the capital Vilnius.

1. **My biggest professional challenge at Messer so far has been...**
   ... building up the medical business from nothing when I joined Messer. The greatest challenge was to prepare and modify all the documentation for medical gases in line with EU regulations within a very short period of time.
2. **What typifies Messer for me is...**
   ... the fact that I have colleagues throughout Europe and beyond, whose friendliness creates a real sense of family.
3. **My strengths...**
   ... are perseverance, meticulousness, communication and the ability to learn quickly.
4. **I have a weakness for...**
   ... spending time with my family and friends, the French language and dancing.
5. **What fascinates you about gases and gas applications?**
   Health-care innovations that involve the use of gases.
6. **The most important invention of the last century is...**
   ... genetic engineering.

Reliable values

Should a car be allowed on the road or not? This vital question is answered at regular intervals by the official exhaust emissions test. The relevant certificate is only renewed if the amount of pollutants emitted remains within the permissible limits. Whether that is the case is usually determined by means of infra-red spectroscopy, where the concentration of pollutants is indicated by the effect of the exhaust gas on infrared light. To determine their proportions, however, it is necessary to have reference values, and these are provided by zero-grade and calibration gases. They thus play a decisive role in protecting the air we breathe, among other things.

This is how the test works in a service garage: a beam of infra-red light is passed through a chamber in the measuring instrument containing the exhaust gases, these being a mixture of different gases. The gases absorb light of particular wavelengths, which differs from gas to gas. The change in the intensity of the light can be measured. The absorption values thus obtained for the different wavelengths indicate the quantities of various vapours, of unburnt fuel, carbon monoxide (CO) and carbon dioxide (CO_2), contained in the sample of exhaust gas. This does, however, require conversion of the measurements that relate to light absorption.

From light absorption to concentration

Two reference points are needed to convert the readings into gas proportions. The first one is provided by a zero-grade gas, a gas of high purity which effectively defines zero for the measurement. The second one comes from a calibration gas, a mixture of gases with a precisely defined composition. "It involves comparing how much light is absorbed when it travels through a pure gas and, for example, through a CO_2 mixture with a known composition," explains Dr. Hermann Grabhorn, who is responsible for specialty gases and analysis at Messer. "These two measuring points can then be used to derive a scale that facilitates the conversion of absorption measurements into concentration values."

Lambda-Mix from Messer is one example of a calibration gas for exhaust emissions analysis. It consists mainly of nitrogen – like the ambient air – and contains precisely specified fractions of CO, CO_2 and propane, which serves as a reference for unburnt fuel. To guarantee the reliability of measurements, instruments used in Germany need to be calibrated once a year. This involves checking their readings against a calibration gas and making any necessary adjustments.

Continued on page 12 →

Cars need to undergo an exhaust emissions test every two years in Germany. This involves sensors being attached to the exhaust and the cylinder head.

Production of handy CAN gas cylinders

The exact exhaust gas values are then determined. Calibration gases such as Messer's Lambda-Mix guarantee the reliability of measurements.

→ *Continued from page 10*

Parts per million and per billion

As a rule, such instruments can measure in the ppm range. This is sufficient for measuring the relevant pollutant levels in the exhaust gas as well as for many other measurements. When it comes to ambient air measurements, i.e. the analysis of those substances that are present in rarefied form in the ambient air but to which humans are still exposed, the concentrations – fortunately – are usually much lower. In these cases, the measurements are often in the ppb range, in other words it involves recording and determining parts per billion, for example to obtain ambient air quality values with regard to the presence of toxic substances such as benzene or toluene in the air we breathe. This requires measuring methods that are much more sensitive than the exhaust gas analysers used in garages. Often this involves the use of gas chromatography, which consists of two steps. First, the sample is broken down into its constituents, the concentrations of which can then be determined very precisely with various detection methods. Heat conductivity, flame ionisation and electron capture detectors, for example, are all used for this. Such methods are utilised in order to analyse air samples from environmental monitoring stations. But gas chromatography is also used in the chemical or pharmaceutical industries, when the accuracy of compositions plays an important role.

High-purity zero and calibration gases being filled into cylinders in the Messer laboratory in Lenzburg, Switzerland

Dr. Zoltán Bozóki explains the set-up of a photoacoustic gas analysis.

Controlled quality

The various methods have two things in common. Firstly, like infra-red spectroscopy, all of them are comparative methods, which need to be calibrated. Secondly, the lower the concentration to be measured and the higher the required measurement accuracy, the greater the requirements for the zero and calibration gases. The production of process and calibration gases requires complex precautions, extreme care in all production processes and continuous quality assurance. This again involves comparisons. The benchmark for this is provided either by gas mixtures which are produced by the relevant national metrological institutes, such as Germany's Federal Institute for Materials Research and Testing, or by certified mass standards.

"Rigorous quality management is absolutely essential in order to be able to guarantee that the calibration gases being produced are always of the highest quality," explains Hermann Grabhorn. In Belgium, France, Serbia, Hungary and Switzerland, Messer has ISO/IEC 17025 accreditation. "This accreditation is official confirmation that our laboratories have the competence to produce and test calibration gases."

Editorial Team

Interview with

Dr. Zoltán Bozóki, Director of Hilase Kft.

"High degree of accuracy thanks to reliable calibration gases"

Gases for Life: Why is it necessary to analyse natural gas?

Dr. Zoltán Bozóki: Natural gas contains hydrocarbons such as methane as well as other components, some of which are undesirable or harmful. The composition can differ greatly depending on the deposit.

Gases for Life: What are the main substances involved?

Dr. Zoltán Bozóki: For one of our customers, we measure the water vapour, hydrogen sulphide (H_2S) and carbon dioxide (CO_2) content. CO_2 reduces the calorific value of natural gas, H_2S is toxic and can corrode the pipes. Finally, natural gas can react with water vapour to produce solid hydrates which block the pipes. That is why these substances need to be removed from the natural gas.

Gases for Life: What role does analysis play in this?

Dr. Zoltán Bozóki: In order to separate an unwanted substance from the useful gases, you need to know the precise amount present. Then, to absorb water vapour for example, you can add just the right quantity of glycol.

Gases for Life: How does the photoacoustic method work?

Dr. Zoltán Bozóki: The gas sample is exposed to laser flashes. Since gas molecules only absorb light of certain wavelengths, substances are heated to differing degrees depending on the wavelength. The fluctuation of heating and cooling causes a vibration which produces a specific sound. We record this sound with a microphone and use it to determine the amount of the gas.

Gases for Life: What are the advantages of this method?

Dr. Zoltán Bozóki: It is extremely cost-effective and robust, and it can be automated. At the same time, it covers a very wide measuring range and is very accurate, helped by the reliable calibration gases from Messer.

Editorial Team

Gas chromatography

Gas chromatography is a widely used and very accurate analytical method for separating mixtures of substances into individual chemical compounds. The sample – a quantity of less than a millionth of a litre can be sufficient – must be gaseous, or, if required, it is vaporised. A carrier gas, high-purity nitrogen for example, then transports it through an extremely thin, long tube (capillary), which is coated on the inside or contains a viscous liquid. The coating and liquid have a resistance effect on the movement of the carrier gas and sample: depending on their physical properties, different substances take different lengths of time to overcome this resistance and reach the other end of the tube. The individual substances can be distinguished on the basis of the pass-through times. Connected detectors can determine the quantities with great accuracy using a variety of measuring methods.

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Hilase Kft.

Hilase was founded by scientists from the University of Szeged (Hungary) and the electronics manufacturer Videoton. The company develops, produces and operates equipment for accurate analysis of the chemical composition of gases and aerosols. Hilase specialises in the photoacoustic spectroscopy method.

Harder through cooling

"Microstructure" and "crystal structure" are among the most frequently used words when metallurgists talk about steel. Besides the chemical composition of an alloy, the main factor in determining the properties of steel is the spatial arrangement of its atoms.

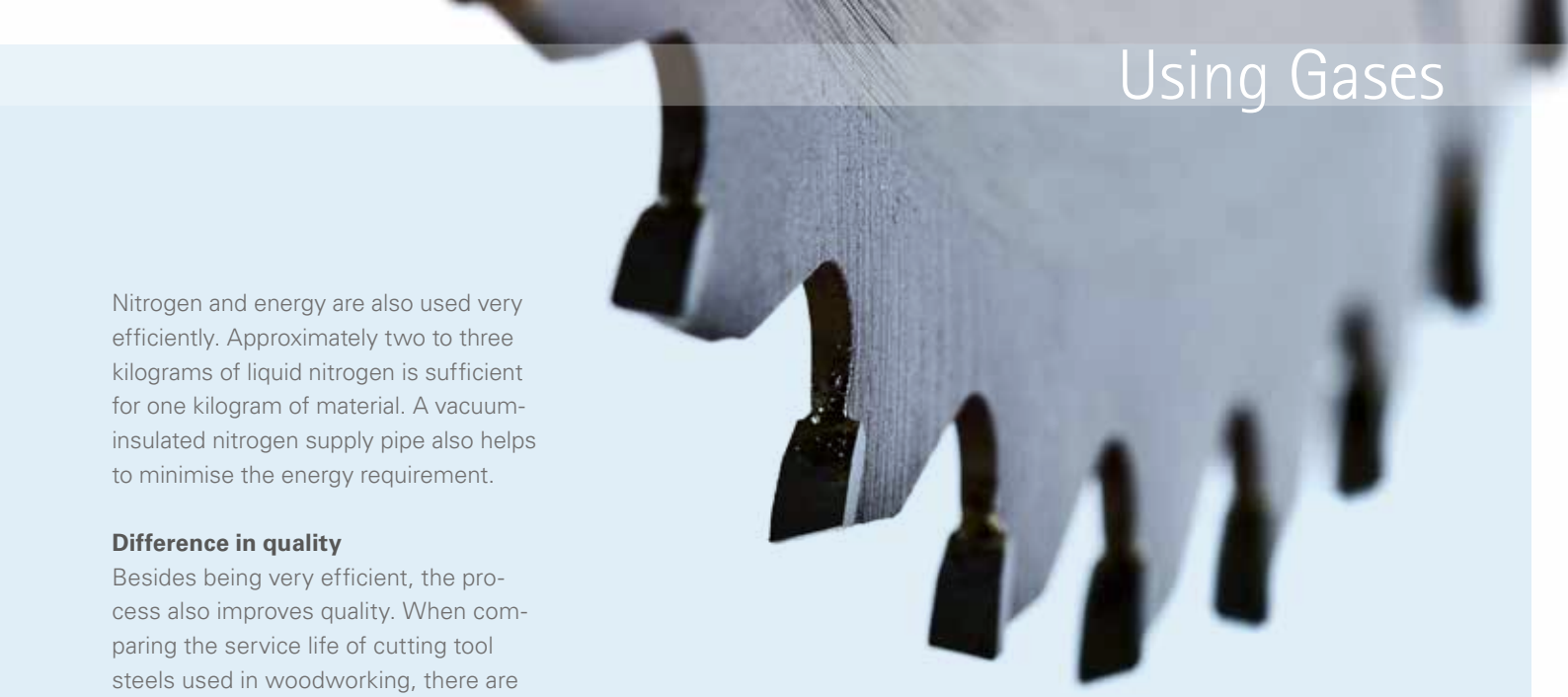
Austenite refers to an iron and carbon crystal structure which is found in many steels but is not always desirable. This structure only has a low degree of hardness and, as a rule, is difficult to cut, which considerably limits the processing possibilities. At Pilana, a Czech tool manufacturer, hardened steel is therefore frozen with nitrogen prior to machining, because at very low temperatures austenite is transformed into different, desirable structural forms. Messer has installed the technology for this and is supplying the nitrogen coolant. Among other things, Pilana produces wood milling machines and circular saw blades, as well as woodworking tools, plane blades and industrial cutters. The company employs 650 staff and is one of the largest tool manufacturers in Europe. The tools are manufactured in compliance with the DIN and ISO standards. A crucial factor here is, of course, the quality of the steel and this, in turn, is dependent on the crystal structure of the material. Depending on the tool and the application, the austenite in the steel needs to be transformed into a different crystal structure – martensite, which has an extremely high degree of hardness.

Clean cut: Cryogenically treated saw blades cut better and last longer.

Lattice change

The classic method of transforming austenite into martensite involves repeated heating and cooling of the material. This takes a long time though and consumes a lot of energy. Cryogenic treatment offers a modern alternative, which saves both time and energy. In 2011, Pilana placed an order with Messer in the Czech Republic to install a facility for the cryogenic treatment of steel for cutting tools. This was designed to allow the steel to be cooled with cryogenic nitrogen to temperatures as low as minus 180 degrees Celsius and to be heated to a maximum temperature of plus 180 degrees Celsius. The centrepiece of the cryogenic process is the injection of liquid nitrogen into the refrigerated part of the chamber. Here, ventilators disperse the cryogenic gas so that its effect on the material is even. The entire cooling and reheating process is pre-programmed and centrally controlled to ensure accurate adherence to all the steel hardening parameters. This includes the cooling rate and time, the retention time for a predetermined temperature as well as the heating rate and time.

The advantage of controlled heating is that the entire process takes place in the box without air ingress. A further benefit is the rapid transition from the held temperature to ambient temperature, which saves a lot of time.



Nitrogen and energy are also used very efficiently. Approximately two to three kilograms of liquid nitrogen is sufficient for one kilogram of material. A vacuum-insulated nitrogen supply pipe also helps to minimise the energy requirement.

Difference in quality

Besides being very efficient, the process also improves quality. When comparing the service life of cutting tool steels used in woodworking, there are measurable benefits from cryogenic treatment. The Austrian company Stora Enso Building and Living, based in Ybbs, has compared steel in tools (blades for removing tree bark) with and without subsequent cryogenic treatment at a minimum of minus 150 degrees Celsius. Cryogenic treatment reduces the tension in the material and facilitates the formation of particularly fine martensite needle grains – a prerequisite for a robust crystal structure. It therefore also facilitates improved cutting performance. Consequently, steels for tools that have been cryogenically treated have a significantly longer service life.

Jiří Svatoš, Messer Technogas

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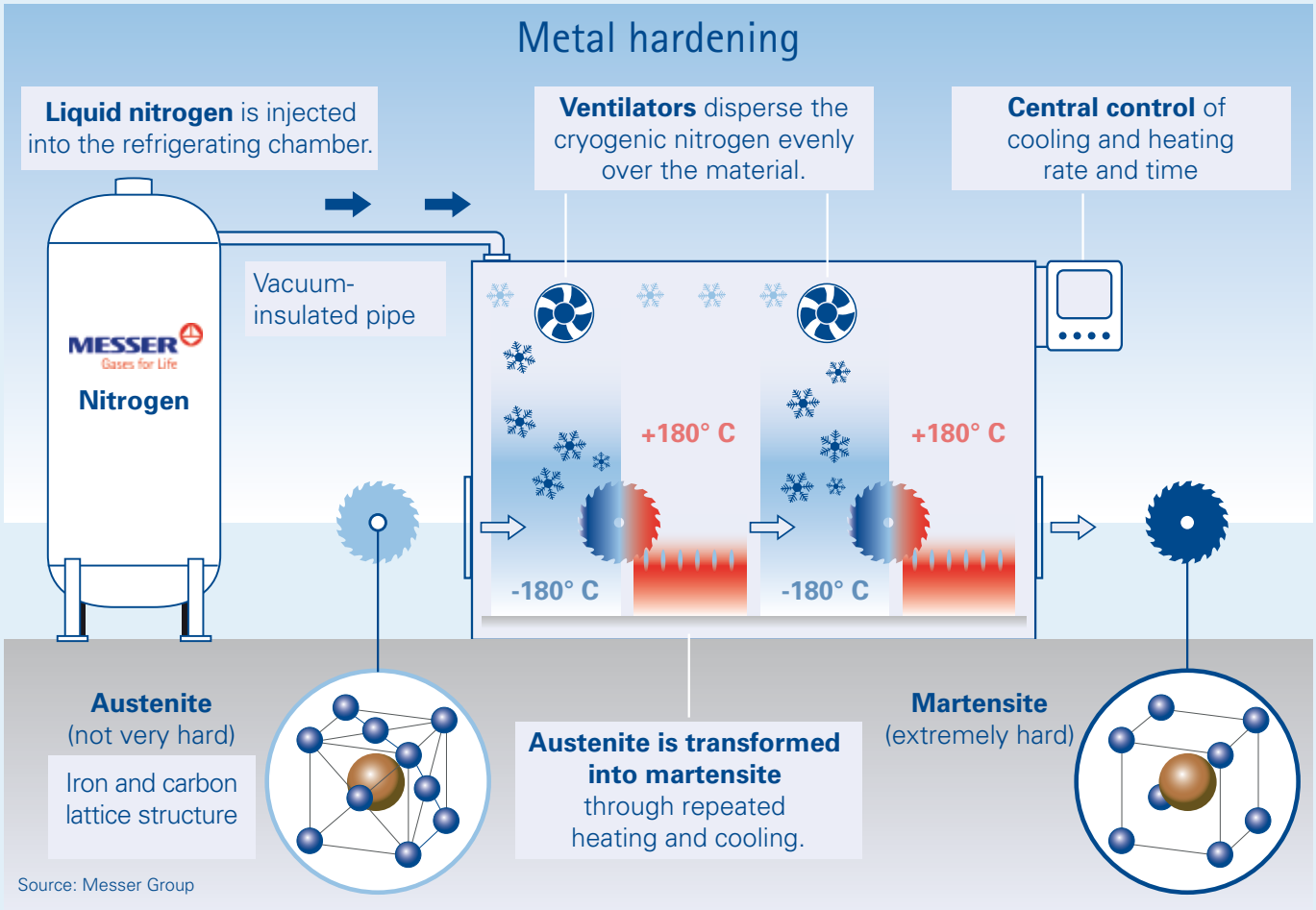
Metal hardening



Source: Messer Group

Graphic: Piet Hamann, www.piethamann.de

Turkey: Aluminium production with liquid oxygen

Furnace with oxy-fuel combustion system

Effective and energy-saving

Combustion processes are intensified by the addition of pure oxygen – yet at the same time they use less energy. Aluminium producer Sahinler Metal, the Turkish market leader in the production of aluminium from scrap and other recycled materials, is making use of this effect: in June 2012, the company had one of the furnaces at its site in Istanbul fitted with a new oxy-fuel combustion system from Messer. Since then, energy consumption has decreased by 50 per cent. Not only did Messer provide the technology, it is also supplying Sahinler Metal with the necessary liquid oxygen. Messer installed a further oxy-fuel combustion system at Sahinler Metal in February 2013 and there are plans for a third system, this time at the company's Ankara site.

Editorial Team

Serbia and Poland: Recycling of refrigerators

Nitrogen against climate killer

The DuoCondex process from Messer is used to clean the waste gas generated by refrigerator recycling plants. In this process, cryogenic nitrogen ensures that the climate-damaging greenhouse gases from the refrigerators' foam insulating material do not escape into the atmosphere. Jugo-Impex in Serbia and Polish company Biosystem S. A., both operators of recycling facilities for waste electrical equipment, have installed the process in the past year.

In the DuoCondex process, the waste gas from the recycling plant's shredder is passed through condensers that are cooled with nitrogen at a temperature of minus 196 degrees Celsius. At these temperatures, the harmful substances condense on the inner walls of the condensers and can then be removed in a systematic way. Jugo-Impex has concluded a liquid nitrogen supply contract with Messer in Serbia for its MeWa-built recycling plant, which went into operation in July 2012 in the Serbian city of Niš. The facility can recycle about 50 tonnes of old refrigerators a day. Biosystem's plant in Bolecin near Krakow recycles 25 tonnes of old fridge appliances per day. With a market share of approximately 24 per cent, it is the second largest recycling company in Poland.

Dr. Friedhelm Herzog, Messer Group

Recycling of waste electrical equipment at Biosystem in Poland

Germany: Recycling with oxygen

Clean acid

Contaminated sulphuric acid is generated as a waste product in numerous manufacturing processes. This can be recycled in a particularly efficient way using oxygen. During thermal cracking, the waste acid is heated intensely and broken down into its constituents, with contaminants being removed at the same time. The use of oxygen as an oxidising agent leads to increased sulphuric acid production and a simultaneous decrease in operating and energy costs. The process therefore helps reduce emissions and save fossil fuels. The efficiency of all waste sulphuric acid recycling processes can be improved with oxygen, with the three main versions in use on the market today being the Grillo, the Lurgi/Stauffer and the fluidised bed processes.

Dr. Walter Bachleitner, Messer Group

Granulated sulphur is used as a raw material for sulphuric acid.

Oxygen optimises melting process for production of insulating materials

Positive overall effect

"Renovating the shells of buildings is the most effective way of reducing our carbon footprint." This sentence from a study by FfE, an independent Munich-based energy research centre, sums it up neatly. Efficient heat insulation actively protects the climate while at the same time saving energy and reducing costs. URSA uses pure oxygen to ensure that mineral insulating materials are also manufactured as energy-efficiently as possible.

URSA is part of the Spanish building materials group Uralita and is one of Europe's leading manufacturers of insulating materials. The company has been producing glass and mineral wool for almost 50 years. Without this non-flammable insulating material, it would be almost impossible to renovate and build energy-saving houses. But first there has to be an input of energy. Stone wool consists for the most part of minerals like limestone, feldspar or dolomite, while glass wool consists mainly of recycled glass. These raw materials are melted at approximately 1,500 degrees Celsius and spun into a fibrous fleece in the liquid state. The amount of primary energy used in this process is quickly offset by the material's insulating effect in buildings. According to the mineral wool industry's trade association, it only takes a few months for the amount of energy saved to exceed that expended.

If pure oxygen is injected into the melting furnaces, as is the case at URSA, the overall effect is even more positive. The gas optimises the combustion process by generating more heat from less fuel. For the same quantity of product, this also means reduced carbon dioxide emissions. At its production sites in Poland, Spain and Slovenia, URSA is supplied with liquid oxygen from Messer's nearby air separation facilities. The carbon footprint of insulating material production is thus further minimised thanks to the short transport distances.

Witold Rammel and Tim Evison, Messer Group

Thermal imaging cameras provide a visual representation of the heat losses from buildings and give a clear indication of where additional insulation is required.

Photos: URSA

Separating air **to obtain gases**

Air is a mixture of gases. It consists for the most part of nitrogen and oxygen, along with small quantities of a number of other gases. To obtain one of these gases in its pure form, it needs to be separated from the mixture.

It is mainly thanks to the different boiling points of the gases that air separation actually works. No doubt the following is something we have all experienced when pumping up a bicycle tyre. The valve gets hot because the pressure in the pump is heating up the air. If the pressure is released, the opposite happens and the air cools down. This phenomenon of a decrease in temperature associated with the release of pressure was first described by the British scientists James Prescott Joule and William Thomson (later Lord Kelvin) in 1852.

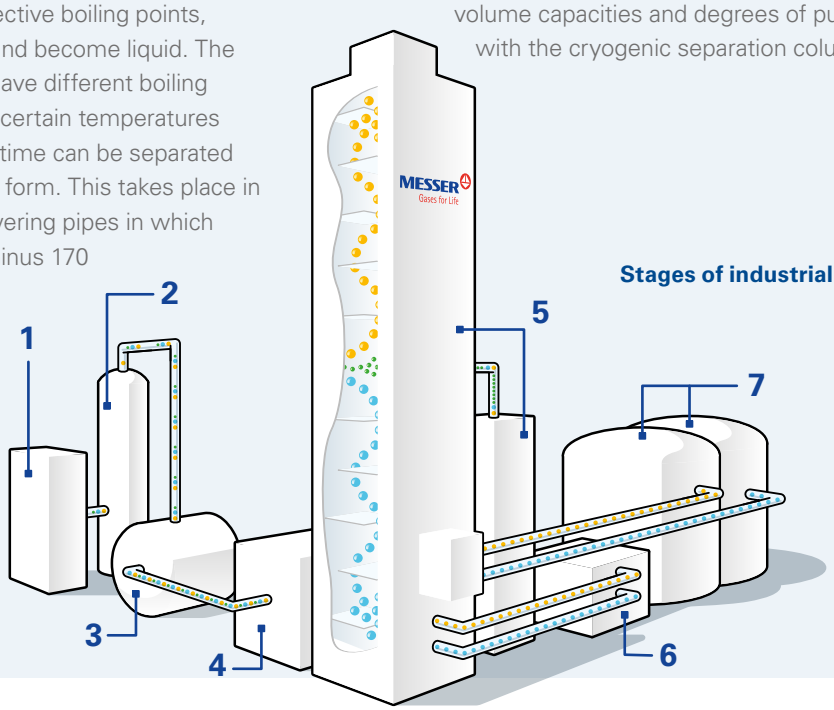
Air separation makes use of the Joule-Thomson effect to cool air to such an extent that the temperature of the individual gases falls below their respective boiling points, causing them to condense and become liquid. The fact that the various gases have different boiling points means that there are certain temperatures where one specific gas at a time can be separated from the air mixture in liquid form. This takes place in the separation columns, towering pipes in which temperatures of between minus 170 and minus 200 degrees Celsius are the norm.

Components of air and their boiling points

Gas	Percentage of air	Boiling point
Nitrogen	78.108%	-196 °C
Oxygen	20.932%	-183 °C
Argon	0.917%	-186 °C
Carbon dioxide	0.04%	None at normal pressure (it sublimes)
Neon	0.00182%	-246 °C
Helium	0.000525%	-269 °C
Krypton	0.000114%	-152 °C
Hydrogen	0.00005%	-252 °C
Xenon	0.000009%	-108 °C

First, by means of substance and heat exchange between the rising steam and the descending liquid, and with continuous evaporation and condensation, the nitrogen, which is still gaseous, is separated from the oxygen, which is already liquid. The other gases are obtained in additional separation columns via further steps in the process. Other methods of air separation use molecular sieves and membranes to separate the gases from one another. However, they do not achieve the volume capacities and degrees of purity that are possible with the cryogenic separation columns.

Editorial Team



Stages of industrial air separation process:

1 Air compression
2 Air precooling
3 Air purification
4 Air cooling
5 Air separation
6 Withdrawal
7 Storage

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We are ...

From left to right: Angela Bockstegers, Benjamin Auweiler, Roberto Talluto, Nicole Urweider, Michael Holy, Mónika Csere, Dr. Joachim Münzel, Diana Buss, Dr. Christoph Erdmann, Tim Evison
(Not pictured: Monika Lammertz, Thomas Böckler, Zsolt Pekker, Marlen Schäfer, Dr. Bernd Hildebrandt, Marion Riedel and Reiner Knittel)

Competition

Yummy ... !

In this issue of the magazine, readers once again have the chance to win a gourmet hamper of products that are produced using gases.

What is the name of the crystal structure that gives metals an extreme hardness?

3+7	6						8		

In which French city is the "Marine Worlds Carousel" to be found?

	2				

Which gas makes up 0.04 per cent of air?

			4			5			9				

For your chance to win this special prize, all you need to do is answer our questions relating to this issue of Gases for Life. The letters in the numbered boxes will give you the answer. Please send it by email with the subject line "Gases for Life competition" to: diana.buss@messergroup.com.

The deadline is 26 July 2013. Please remember to include your name and address.
The competition is not open to employees of the Messer Group or their families. In the event of multiple correct answers, the winner will be picked randomly. The result of the draw will be final and not subject to appeal.

Congratulations!

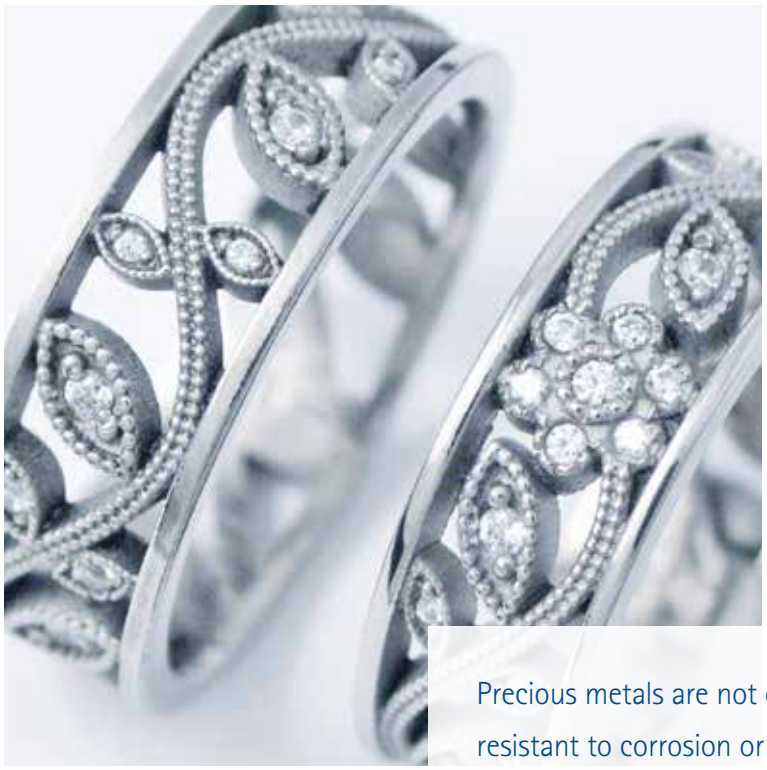
The winner of the last competition was Christian Vogt, Plochingen, Germany. The correct answer was „CHRISTO".

Answer:

	2	3	4	5	6		7	8	9
L						-			

Have fun and (with a bit of luck) enjoy the hamper of goodies!
Your Gases for Life team!

Ornamental jewellery



Precious metals are not only attractive, they are also resistant to corrosion or oxidation. More often than not, though, such metals are used in alloys – i.e. mixtures of several metals, when they are made into ornamental jewellery. This unfortunately means that oxidation can occur after all during melting and casting. At Farkas Ékszer goldsmiths in Budapest, air is extracted from the melting furnace and replaced with the inert gas argon to prevent such oxidation. This ensures that the jewellery retains its lustre and shine for a long time to come.

For more on this and many other gas applications, go to:

www.Gases for Life.de