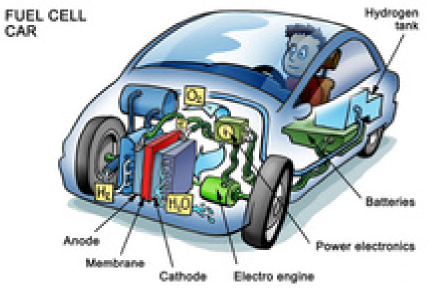
Development of polymer membranes

The Nanoscience Institute of Aragón in Zaragoza is supported by Memmert vacuum ovens in its research, in particular into the development of a polymer membrane with improved permeability and selectivity. (Glossary at end of article)



The **fuel cell** in the vehicle is just one of many fields of application for the **polymer membrane**

Gas separation is a frontrunner in environmental technology

An increasing environmental awareness provides **environmental technology** with ever more growth opportunities through the development and deployment of innovative technologies. Just one of many examples is the **polymer membrane**, used to separate materials and for microfiltration. Depending on its structure, it allows gas or water to permeate on one side, or only allows certain microparticles or organic materials to get through. Fields of application include the processing of biogas through **CO2 separation** or energy-saving **seawater desalination**. The **polymer membrane** has attracted much attention as a central component of the **fuel cell**, where it is not only responsible for **gas separation**, but as an electrolyte, also conducts the protons. Many university institutes and industrial research institutions worldwide are devoted to the task of producing these components more cheaply, while at the same time improving the essential properties in terms of resistance to temperature, **gas permeability** and **selectivity** for specific gases. One of them is the **Nanoscience Institute** of Aragón of the University of Zaragoza, gathering renowned experts in the fields of Nanobiomedicine, Nanostructured Materials and Physics of Nanosystems from around the world.

Environmental technology: Waste-to-energy

Reduced drying time in the **vacuum drying oven** optimises operating procedures in waste management...

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Drying and degassing in the vacuum drying oven

One research project of INA dealt with the development of a composite **membrane** with **polysulfone**, a plastic resistant

Electronics: component manufacture

Drying time for humidity-sensitive electronic assemblies in the to high temperatures, as a **polymer matrix** as well as spherical ordered **silica** (SiO2) particles as a **filler**. The morphology and homogeneity of the particle distribution in the **membrane** was examined at different strengths, as well as the properties at different weight proportions of the spherical **silica** particles. The actual size proportions are far from the illustrative graphic above, portraying a **fuel cell**. The thickness of the membrane ranges from 75 to 100 µm and the **silica** particles are about 3-4 µm in diameter. A vacuum is required twice for the various experiments. On the one hand, the **polysulfone** must be dried in the vacuum for four hours at 100 °C before it is combined with the **filler**, on the other the **membrane** films which have been dried at room temperature are degassed at 10 mbar and 100 °C for one day in the **vacuum drying oven** to remove the solvent remaining from the **polymer** production.

electronic assemblies in the **Memmert vacuum drying oven** reduced by more than 13 hours...

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Coating materials for medical technology

The dehydration of titanium powder in the **vacuum oven** is an important process step in the powder metallurgy of the Nuremberg high-tech company GfE…

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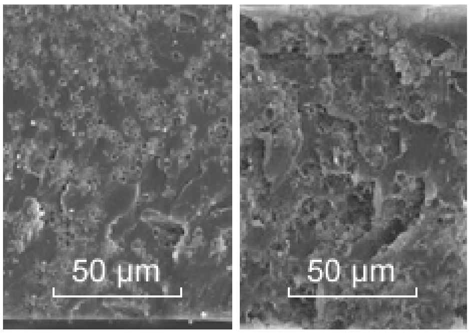
The results: Reduction of the proportion of filler for a better permeability and selectivity

Production of **membranes** was followed by numerous investigations with scanning electron microscope, thermogravimetry, infrared spectroscopy as well as X-rays, mechanical load tests and measurements of the **permeability**. It was seen here that with the selected material combination of **polysulfone** and **silica**, the proportion of **filler** can be kept low, although **gas permeability** and **selectivity** could be improved. The full publication is available from ACS Publications. Our special thanks go to Prof. Joaquín Coronas and Dr. Carlos Téllez from the University of Zaragoza for their support in writing this application report.



The scanning electron microscope clearly illustrates the homogeneity and morphology of the **filler silica** in the **membrane** with an 8 and 12 % weight proportion

Glossary

- Electrolyte: Chemical substance that conducts electricity when voltage is applied
- Composite material: Particles or fibres of other materials are embedded into the so-called matrix of the source material (e.g. **polymer matrix**)
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Drying ovens for industrial applications

Vacuum oven VO

Universal oven U

- Matrix: Fastens the fibres or particles in the plastic compound
- **Permeability**: Porosity, e.g. **gas porosity**
- **Selectivity**: Scale of the narrrowness of a selection
- **Silica**: silicon dioxide is a fireproof ceramic material (SiO_2)
- **Polymer**: Chemical compound of molecular chains (e.g. synthetic materials such as polypropylene and polyamide or organic **polymers** such as proteins and DNA)

An overview of focus topics

- **Polymer membrane**
- **Environmental technology**
- **Gas separation**
- **Seawater desalination**
- **Co2 separation**
- **Drying** in the **vacuum drying oven**
- **Degassing** in the **vacuum oven**
- **Polymer matrix**
- Improvement of **permeability** and **selectivity**
- **Filler silica** and **polysulfone** matrix

Picture credit: imageproduction.nl, Institute of Nanoscience Zaragoza

Autor: Memmert GmbH + Co.KG

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www.atmosafe.net > Applications > Degassing under vacuum > Polymer membrane

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