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Continuous Improvement

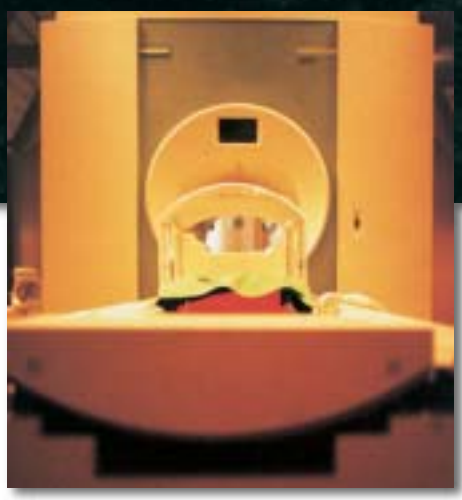
Special flasks for helium produced from a high-purity grade of Schott's "Supremax" glass play a crucial role in a new and trailblazing method of pulmonary diagnostics.

A volatile gas opens new horizons in medical diagnoses for the early detection of pulmonary diseases. Helium-3 is a hyperpolarized version of the inert gas and is widely used in nuclear spin tomography, which makes use of magnetization effects to produce computer images of the body's interior. When a patient inhales the pre-magnetized inert gas, with the help of tomography it is possible to obtain a spatial presentation of pulmonary ventilation with a much higher resolution than in the past.

The quality of these images allows an assessment of the efficiency or malfunction of the lungs early enough so that therapy is possible before irreversible damage can occur – and this without any harmful organic side effects resulting from the process. The method is suitable for (serial) examinations of all age groups ranging from young children to adults, according to the Körber Foundation for European Science in its booklet published on the occasion of the presentation of its international award recognizing this new method.

The award was bestowed on four scientists and professors: the physicists Ernst W. Otten, Werner Heil and Michèle Leduc as well as the radiologist Manfred Thelen. Otten and Heil played a central role in the development, polarization and production of helium-3. The two physicists at the Johannes Gutenberg University in Mainz contacted Schott concerning the development of special helium flasks, since volatile helium-3 needs a storage container whose composition ensures that the precious contents are absolutely protected against any influence.

The application of the inert gas helium-3 helps produce an improved image of pulmonary ventilation in tomography.



Flask production under laboratory conditions

"Even the slightest iron impurities in the starting materials used for glass production can upset the magnetization effect. This is why we devised a recipe based on high-purity raw materials for our 'Supremax' glass, which led to the fabrication solution," explains Dr. Uwe Kolberg, who is responsible for model production in Schott's melting laboratory. The melting process also requires clean conditions and production instruments that will not cause impurities. Thus the metal blowpipes to blow the glass flask materials are given a platinum coating to protect against metal discharges.

The development of this glass container was made possible through intradepartmental teamwork and a highly efficient melting laboratory specialized in individual and high-quality solutions, small-scale production for internal and external purposes – also as a pre-stage for large-scale production. According to Dr. Kolberg, however, this model is not expected to go into mass production for the time being. In this particular case, long-term customer commitment plus Schott's and the Carl Zeiss Stiftung's dedication to the foundation's underlying principle of promoting science and research play the central role. This support is also demonstrated by the Schott Foundation's financing of the project.

Professor Ernst W. Otten of the Johannes Gutenberg University in Mainz, is one of the winner of the international award of the Körber Foundation for European Science. He made a major contribution to the development of helium-3, which is highly useful in pulmonary diagnostics.

Schott produces special glass containers made from high-purity raw materials for the safekeeping of volatile helium-3.

Professor Ernst W. Otten
Johannes Gutenberg University, Mainz

Ready for market launch in three to four years

Professor Otten, what are the challenges of your method?

Otten: First, it is important, and complicated, to produce large quantities of helium with a high degree of polarization. Each patient has to inhale a liter of helium-3 for a tomographic examination. Second, you have to delay the decay time of the helium-3 magnetization because of the transport to clinics, and this is where the iron-free glass containers from Schott play an important role.

How do Schott's helium flasks help alleviate this problem?

Otten: Specialists fabricated the first flasks last year and have since continuously improved them. Thanks to these flasks, we have ultimately achieved a helium polarization "life span" of some 50 hours and can produce some 50 to 100 liters of polarized helium-3 per day.

Is the new method already in clinical use?

Otten: We are pursuing medical registration and already supply three clinics in Mainz, Sheffield and Copenhagen, where, as part of a trial, patients are being examined using this method.

Interview

Five spools produce a magnetic field in which helium-3 is polarized with an infrared laser.