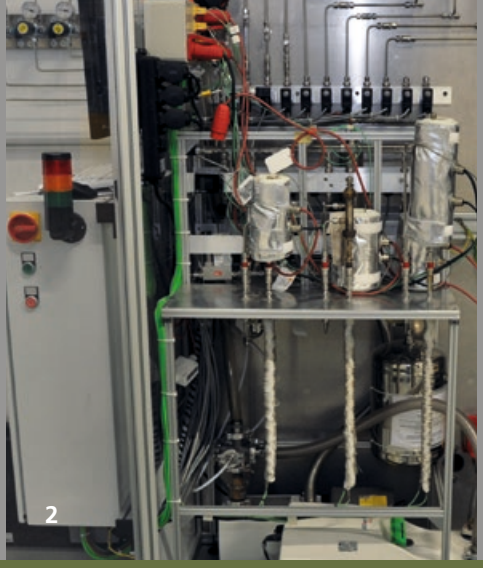

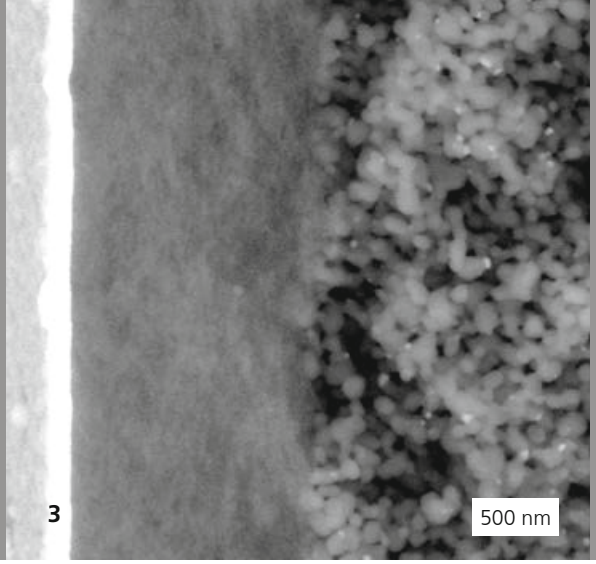

PALLADIUM MEMBRANES FOR H_2 SEPARATION FROM HOT AND HUMID GASES

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Motivation

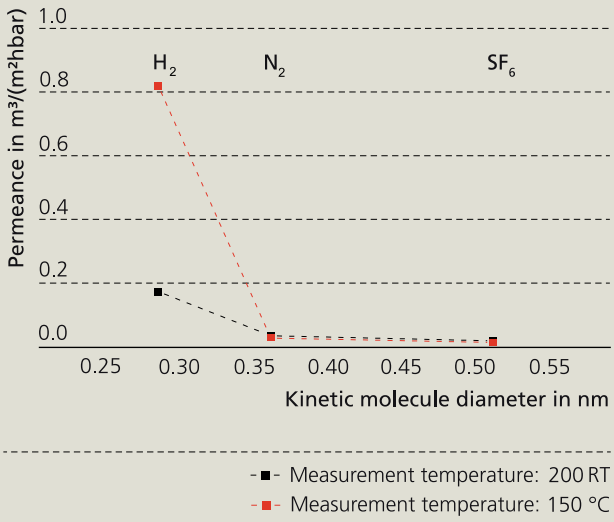
Membranes are increasingly of interest for industrial processes because they enable energy-saving methods for separation. The separation of gas molecules is one possible field of such an application. The kinetic molecule diameter of gas molecules is significantly below 1 nm, which means there are specific requirements for the membrane: its layer should be free of defects and provide both high permeance and high permselectivity.

Current research at Fraunhofer IKTS

The choice of a specific membrane depends on the type of separation task. Fraunhofer IKTS has developed and characterized various membrane materials. Particularly, the separation of hydrogen from hot and humid gases puts high demands on the membrane material with regard to thermal and chemical stability. For such separation tasks, Palladium (Pd) membranes are candidates with high potential, since Pd is only permeable for hydrogen. Such membranes were prepared at IKTS using an innovative wet chemical method on porous, ceramic substrates. The synthesis method leads to very thin and dense membrane layers with high selectivities. Figure 1 represents a scanning electron microscopy image of the cross section of the membrane on a ceramic support. The Pd layer is approx. 200 nm thick. In the SEM image it appears as a white layer.

The characterization of the membrane was carried out through single-gas permeation measurements of different gases. The H_2/N_2 permselectivity level > 150 exhibited by the membrane is ideal. The very low SF_6 flow indicates that very few defects are included in the membrane layer, or even that their number is non-significant. Thanks to the low thickness of the Pd layer the permeance is very high. This allows for lower application temperatures and opens up new areas of application.

Single-gas measurements of a palladium membrane



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1 *Uncoated single-channel geometry (left) and coated inside of a substrate (right).*
2 *Automated test rig for gas permeation measurements.*
3 *SEM image of a Pd membrane (white) on ceramic substrate.*

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