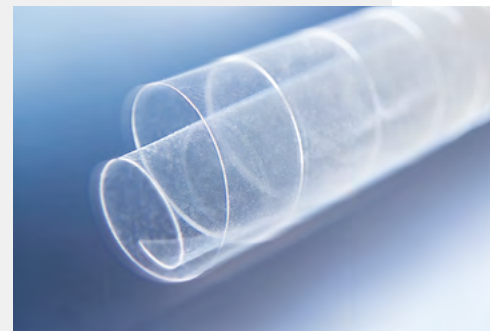


Membrane Humidifiers

The humidification solutions based on FUMATECH membranes improve the humidification efficiency. The fumasep® humidifier membranes are highly permeable to water vapor. The humidification membranes keep low pressure loss over the whole operation range. They are adaptable as passive type without external power and water supply. The size of fumasep® humidifier membranes is tailored to customer specific needs.



BUILD YOUR OWN HUMIDIFIER WITH FUMATECH

The flat sheet membranes for water transfer applications are based on perfluorinated sulfonic acid polymers and multi-layer reinforcement. The type of polymers and membrane morphology are optimized for heat and water transfer rates in applications for fuel cells and house moisturizing.

Make your system reliable and efficient!

- Economical & Optimized Solution for PEMFC System
- Automotive, Forklift, Back-up, Industrial, mCHP Applications
- Available at Low to High Pressure Operation
- Excellent Heat and Moisture Transfer Efficiency
- Low Pressure Drop & High Thermal Durability
- Customizable with regard to Membrane & Module
- Mass & High Speed Production

The structure of fumasep® humidifier membrane (FSSM-7100-PET and FSSM-7200-PET) is made of two outer non-woven microporous layers covering symmetrically a very thin selective layer (below 5 µm) in the middle.

The selective layer is made of reinforced PFSA material.

The water vapor is transported through the selective layer according to the solution-diffusion model.

The air flow (wet/dry) streams along the surface of the selective layer. The water vapor is absorbed by the air of lower humidity while the air diffusion is blocked.

The water transfer rates are very high (see Fig. 2).

The non-woven-material that protects and supports the selective layer is typically sealed by screen-printing, adhesive or welding technology.

An example of membrane-spacer-assemblies is described in Fig. 1. As sealing, lamination with a netting silk (blue color) is done by screen-printing technology on the surface of both microporous layers of the membrane to a so-called half-cell that can be easily stacked to a module.

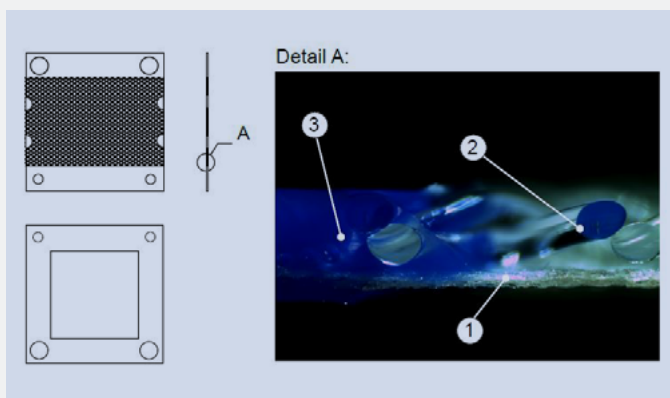


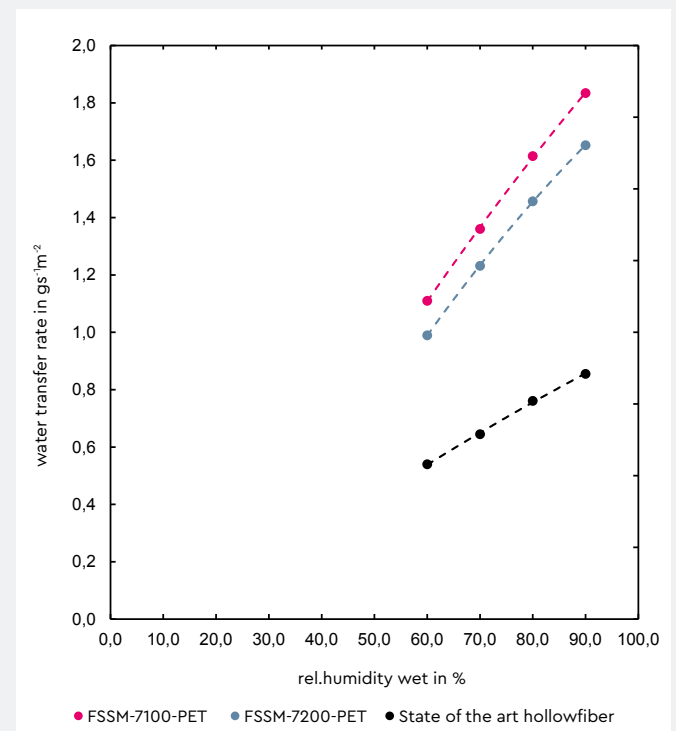
FIG. 1: Cross-section of membrane-spacer-assembly (MSA) made of netting (2) sealed (3) with the fumasep® FSSM-7100-PET membrane (1). Refer to position A at the sketch.

TECHNICAL DATA

General Specifications	
Membrane*	approx. 3 m ² active humidifier membrane area for 45 to 90 kW FC stack
Rated Air Flow*	up to 900 NL/min·m ²
Flow Configuration*	Counter & Co- and Cross-Current
Life Time*	Stationary > 7.000 hours
Operating Temperature	- 30 °C to 110 °C
Operating Differential Pressure	up to 50 kPa
Total Air Pressure Drop*	membrane independent, driven by spacer type
Linear Dimensional Stability of Membrane	< 1 % at 100 % r.h.
Materials of selective layer	reinforced PFSA
Materials of support layer	Polyester, Polyphenylensulfid
Membrane weight	approx. 60 g/m ²
Membrane thickness	differ approx. 100 – 300 µm

(* the noted specifications are estimated empirical values which depend on stack design)

FIG. 2: Performance data of single cell test



Test conditions: Measurements are made in a single cell unit in counter flow with equal active membrane area. The dry air flow rate is 10 norm liter per minute. The temperature is 80 °C. The flow geometry of the flat membrane cell is a spacer with an open area of larger than 60 percent.