

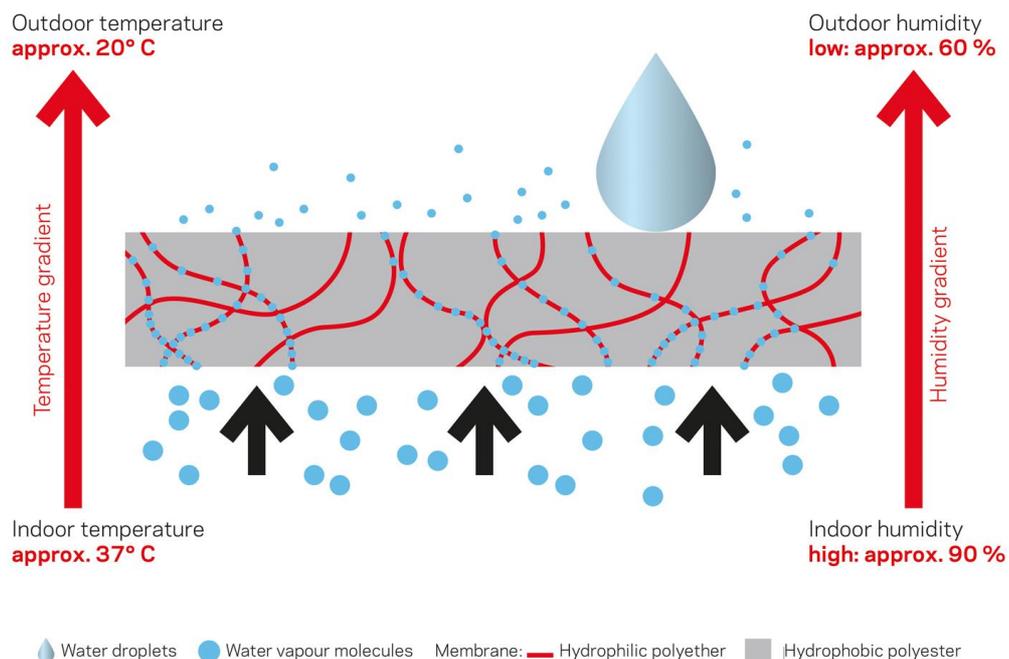
Factsheet Sympatex “breathing” glove

Sympatex Technologies GmbH:

The “breathing” glove for medical & industry purposes

Die Sympatex Technologies GmbH presents a “breathing” glove for the sector “Medical & Industry” at Techtextil 2015 for the first time. Core of the product idea of the Sympatex® business unit “Technical Applications” is a two dimensional glove made out of the compact semipermeable ‘guaranteed green’ Sympatex® membrane. It is made of completely safe polyether/ester, a combination of polyester and polyether molecules, and 100% recyclable. It is PTFE-free and PFC-free and therefore is completely eco-friendly as well as kind on the skin. The Sympatex® membrane is 100% water- and windproof as well as optimally breathable. Semipermeability means that water vapour molecules can permeate through the membrane whereas liquids like water e.g. will be prevented to penetrate through the membrane (see illustration 1). The “breathable” glove will be worn under occlusive and impermeable protective gloves made out of PVC (Polyvinylchloride), nitrile etc., which are used in the occupational practice (e.g. protective equipment against chemicals).

Illustration 1: The functionality of the compact hydrophilic Sympatex membrane





Concept:

The Sympatex® “breathing” glove represents a new, unique and innovative product concept. The effectiveness of the concept has already been proven over the last few years based on different scientific studies under the leadership of the University of Osnabrück, Department of Dermatology, Environmental medicine and Health Theory.

Functionality

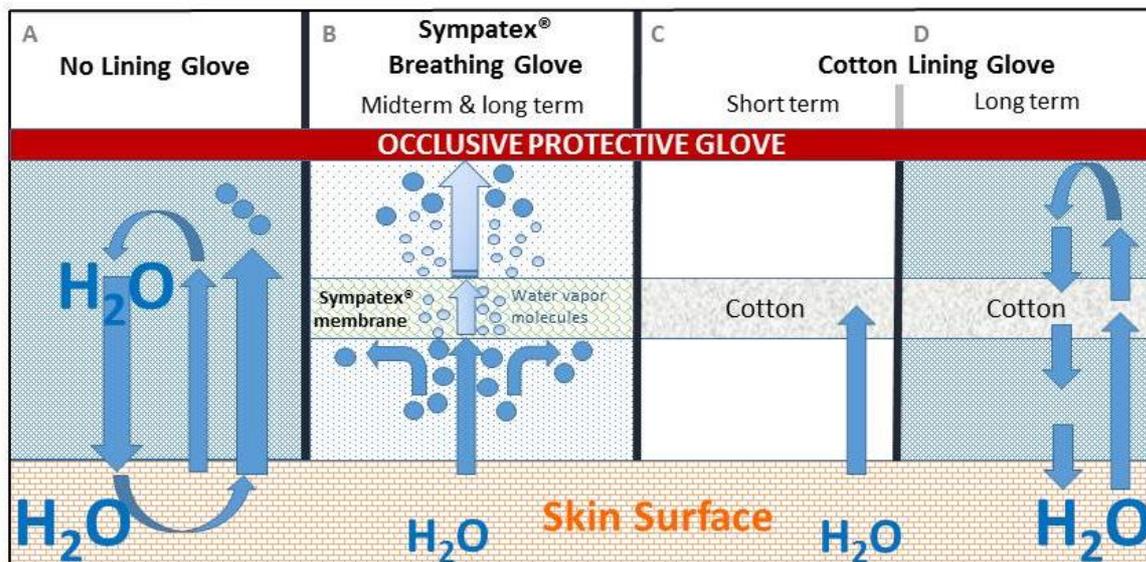
In many different professions like medical, electric and metal industry, cleaning and food processing professions impermeable protective gloves are often worn over long time. Wearing impermeable gloves over longer time may cause negative occlusion effects like sweating hands, irritated skin and also may lead to occupational skin diseases (see illustration 2/A).

The reasons for these effects are an accumulation of warmth and moisture under the occlusive and impermeable protective glove caused by sweating. Sweat leads to a swelling of the outermost horny layer of the skin. After removing of the occlusive glove, this additional moisture evaporates and the horny layer remains dehydrated and may cause further damage to the physiological skin barrier. Wearing an additional inner Sympatex® “breathing” glove reduces the accumulation of warmth and moisture. The moisture in the form of water vapour resulting from sweating, permeates along the diffusion gradient through the membrane in the small room between the lining glove and protective glove or via the cuff to the outside the glove (see illustration 2/B).

The Sympatex® “breathing” glove will be available in the sizes XS, S, M, L and XL and can be disinfected or washed after wearing and has a multiple usage of about 5 times.

So far, there is no comparable semipermeable occupational protective glove on the market. The only alternative currently used in order to reduce the described negative occlusion effects are cotton gloves which will be worn under impermeable outer gloves. For a short period of time they are also effective, but after longer wearing periods, which are prevalent in many occupational settings, they are fully soaked with sweat and will not anymore prevent the horny layer from swelling (the first step of water-/moisture-induced skin damage) in order to maintain the best physiological skin barrier (see illustration 2/C and 2/D).

Illustration 2: The influence of different combinations of gloves on the skin



A: Wearing of occlusive and impermeable protective gloves cause an accumulation of warmth and moisture under the glove and let the skin swell („Washwoman hands“).

B: When wearing the semipermeable Sympatex® Breathing Glove the humidity will be transported over a diffusion gradient in the form of water vapor through the membrane. Inside the poreless Sympatex® membrane water vapor molecules will be either transported along the hydrophil molecule chains into the glove interspace (ventilated area between Breathing Glove and protective glove) or via the glove cuff to the outside. Occlusive based swelling of the skin will be antagonized.

C: Wearing of cotton lining gloves prevents short term creation of humidity and warmth accumulation, as water which will be released e.g. from the perspiratory gland will be absorbed by the hygroscopic fibres of the cotton.

D: After longer wearing time of the cotton lining glove (for some wearers process is starting already after 5 minutes) the cotton is saturated. From the time when that happens the functionality is completely exhausted and an accumulation of humidity and warmth will be created which let the skin swell.

“Healing properties” of the Sympatex® membrane:

Additional effects which have been proven to a certain extent by the University of Osnabrück, Institut iDerm, are related to the healing properties of the Sympatex® membrane. For the evaluation of the regenerative effects of Sympatex® “breathing” gloves, also as underliners, a standardized irritation was induced by occlusive application of a 0,5% SLS-Solution (Sodium Lauryl Sulphate) over 24 hrs at the volar forearm. In the next step these areas have been covered at 3 consecutive days for 6 hrs/day with three different material combinations:

- Sympatex® membrane + occlusive cover (Vinyl)
- Occlusive cover alone (Vinyl)
- Control area without cover

Based on this test set three skin physiological parameters: TEWL (transepidermal water loss as parameter for the integrity of epidermal barrier), RHF (relative humidity of the horny layer as



parameter for skin dryness) and a^* (erythema index as parameter for skin redness or erythema) have been measured. The result (see illustration 3) is that the Sympatex® “breathing” glove membrane shows positive effects in all three criteria. The value for the parameter a^* shows an advantage over an occlusive cover and also an advantage over the control position “no cover”. This reflects the “healing properties” of the Sympatex® “breathing” glove membrane. The Sympatex® membrane matches the ideal (physiological) TEWL, which means that the right amount of water vapour can transmit through the membrane.

Illustration 3: Summary of the skin physiological results

Conclusion of skin physiological results

| | without covering | occlusive cover | Sympatex cover |
|-----------------------------|------------------|-----------------|----------------|
| Barrier-regeneration (TEWL) | + | - | + |
| Skin dryness (RHF) | - | + | + |
| Inflammation (a^*) | 0 | - | + |

+ positive Effect - negative Effect 0 no Effect

Scientific Background:

The effects of the Sympatex® “breathing” glove described earlier have been investigated latest in a prestudy carried out in cooperation between the iDerm (Institute for Interdisciplinary Dermatological Prevention and Rehabilitation at the University of Osnabrück), the BGW (German Social Accident Insurance Institution for the Health and Welfare Services) and Sympatex®.



A further study under the responsibility of the iDerm and the BGW will be executed in 2015/2016. Volunteers for this study will be recruited from the insured people of the BGW, who suffer of occupational skin diseases.

Summary:

The Sympatex® “breathing” glove can make the professional life of employees which have to work long time per day with impermeable gloves much more comfortable, healthy and pleasant. The results of the previous scientific investigations show that skin irritations or even serious occupational skin diseases caused by occlusive effects of impermeable protective gloves can be avoided or at least considerably reduced by using Sympatex® “breathing” glove liners. This makes the Sympatex® “breathing” glove equal to a preventive measure for many professions and treatment costs can be reduced. Further effects like the “healing effects” of the Sympatex® “breathing” glove on existing skin irritations or occupational hand eczema provide even more benefit for affected people in many professions. This should make the Sympatex® “breathing” glove to an essential product for the prevention of occupational skin diseases.

The results of the cooperation project between the University of Osnabrück and the German Social Accident Insurance Institution for the Health and Welfare Services strongly indicate that there would be a unique benefit by wearing semipermeable protective gloves for the prevention of occupational skin diseases:

- (a) by minimizing glove-induced occlusion effects and irritation in healthy and damaged skin
- (b) by enhancing barrier recovery through protective glove-materials at the work place in cases of pre-existing minor irritant dermatitis. Considering the fact that many wet-workers start using gloves only after the occurrence of initial skin damage.

Short version:

The Sympatex® “breathing” glove represents a new, unique and innovative product concept. Core of the product idea is a two dimensional glove made out of the compact semipermeable ‘guaranteed green’ Sympatex® membrane based on 100% polyester-/polyether. The Sympatex® “breathing” glove will be worn under occlusive and impermeable protective gloves made out of PVC (Polyvinylchloride), nitrile etc.

The Sympatex® “breathing” glove offers the following main features:

- Semipermeability (water vapour can penetrate through the membrane, whereas liquids stay outside)
- Maintains best physiological skin barrier



- Reduces negative occlusion effects like sweating hands, irritated skin and occupational skin diseases.
- Offers further “healing properties” on existing skin irritations or occupational hand eczema
- Available in sizes XS, S, M, L and XL
- Disinfectable and washable
- Multiple usage up to 5 times

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