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# The effect of garment interlayers on evaporation resistance of textile laminates with hydrophilic membranes

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Water vapor permeability, often expressed as evaporation resistance Ret, belongs to the most important thermal comfort parameters of protective, sport and other functional clothing (garments) and related textile fabrics. Water vapor permeability of all textile products should be as high as possible, in order to prevent the accumulation of sweat in the garment system and simultaneously enable efficient cooling of a body by the sweat evaporation. For outdoor or industrial applications, these garments should also exhibit the so-called semipermeability: the textile laminates creating the outside garment fabrics contain micro - or nanoporous membranes, which prevent the penetration of outside liquid water into the laminates, but simultaneously allow the passage of water vapour from the body through the whole fabric system.

In microporous membranes, their semi-permeability is given by their porosity, practically independent of the average moisture level inside the membrane. Contrary to that, water vapor resistance of nanoporous membranes depends strongly on the average moisture level inside the membrane. The average moisture level inside the fiber structure is then proportional to the moisture level (characterized by water vapor partial pressure) on both sides (surfaces) of the nanoporous membranes.

In the study, a new observation based on the above requirement of the highest level of water vapor partial pressure on both membrane surfaces, is presented. It was found, that when a jacket containing a nanoporous membrane is worn over an underwear garment system with high thermal (and also evaporation) resistance, then the average moisture level inside the nanoporous membrane can be significantly lower, then in case of testing the only nanoporous laminate in a testing instrument. This low moisture inside these membranes will significantly reduce WV permeability of the laminates. That is why the effective water vapor permeability of e. g. outdoor jackets with nanoporous membranes, when worn over several fabric layers, can be much lower than marketed levels of these outdoor garments. Clients wearing these clothing may suffer from sweat accumulation and overheating caused by reduced transfer of the evaporated sweat.

**Keywords:** textile laminates, hydrophilic membranes, water vapor permeability