Research on dynamic insulation technology applies on houses

What is Dynamic Insulation Technology (DI Technology)

▶ Principle: This technique is the principle that advection prevents fresh air outside the room from flowin g in the room by passing through the porous material with air permeability, so that heat transfer in the dir ection opposite to the incoming air current is prevented by advection. The adiabatic performance of this t echnology is calculated based on the thermal equation, heat loss during the winter season, heat suppress ion in summer.

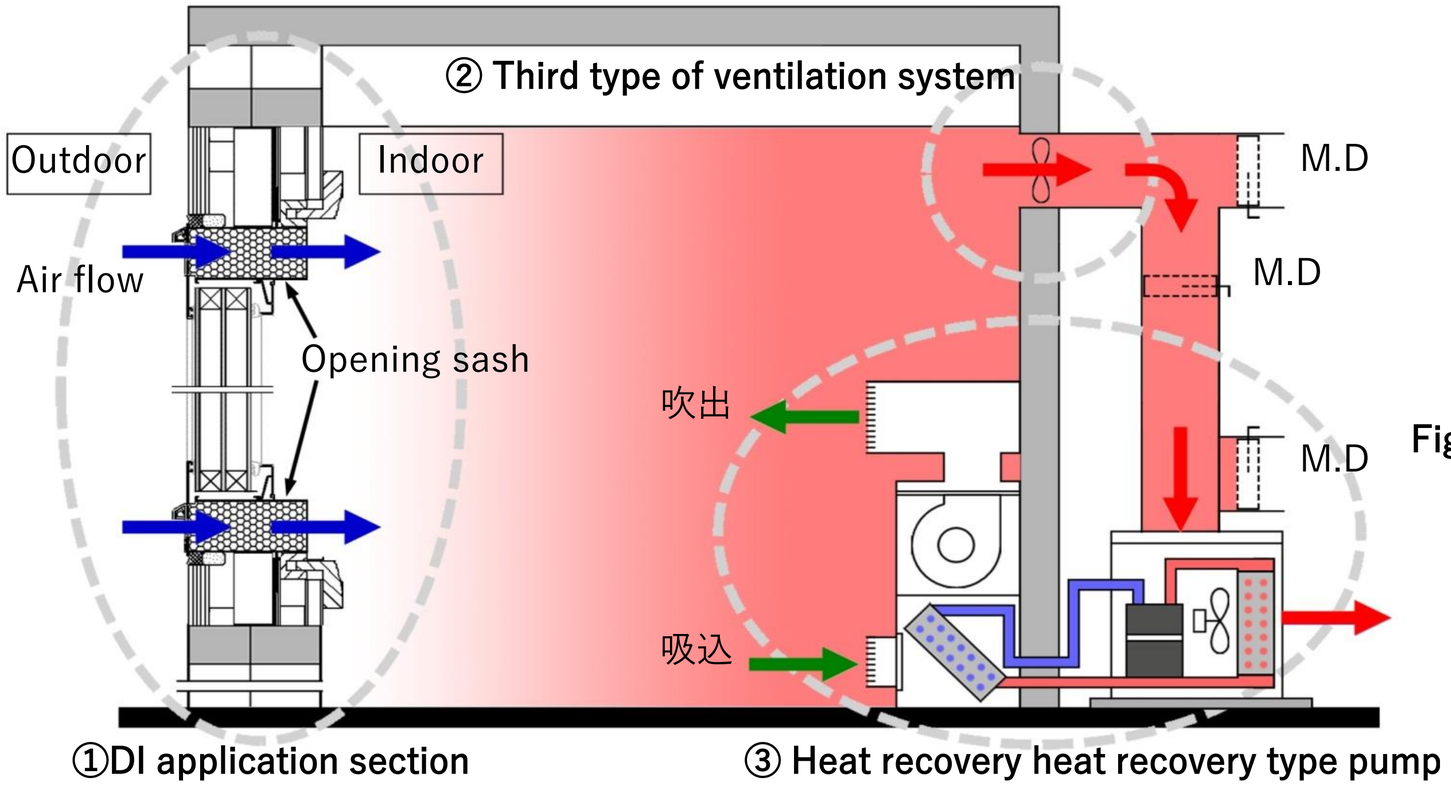

Figure 1 Ventilation system of residential houses with dynamic insulation technology in winter

Winter : Decompression of interior by third type ventilation equipment
Summer : the interior is pressurized by Class II ventilation equipment

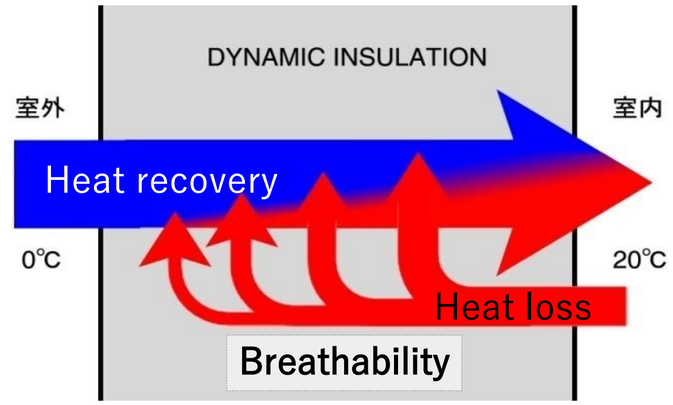

Figure 2 Conceptual diagram of dynamic insulation

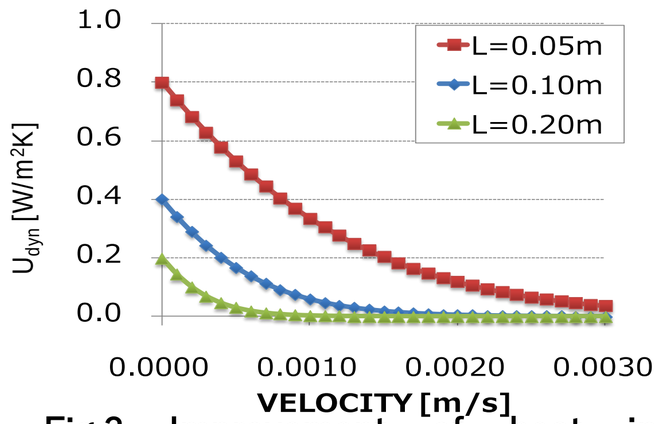

Fig.3 Improvement of heat insulation performance by ventilation speed

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Technical applications

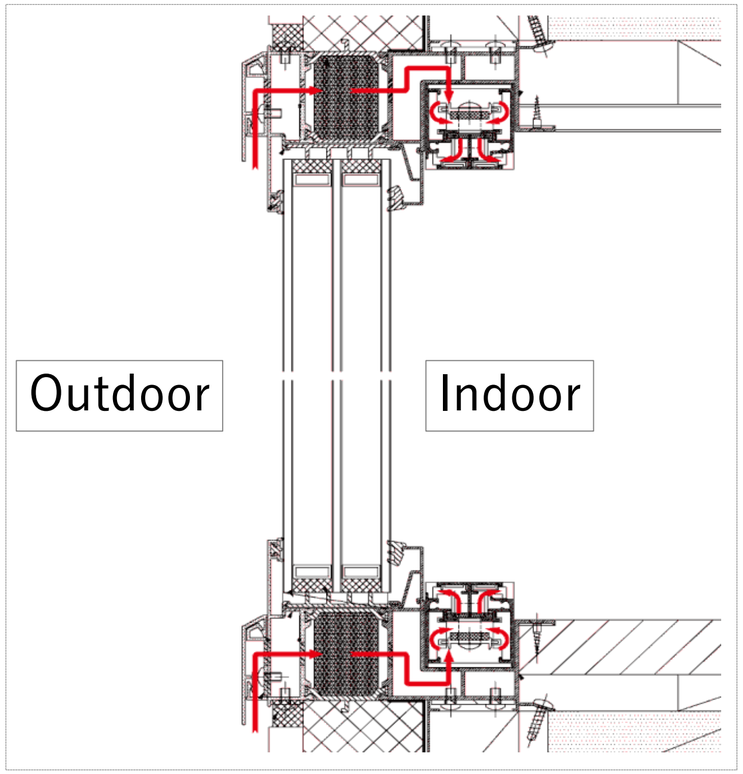

Figure 4 Frame with DI technology applied

- Porous material is installed inside the DI application part, and flow rate adjustment is possible
- Inflow from each side
- Triple is used for window glass
- (Heat transmission coefficient of 0.7 W / m 2 K)

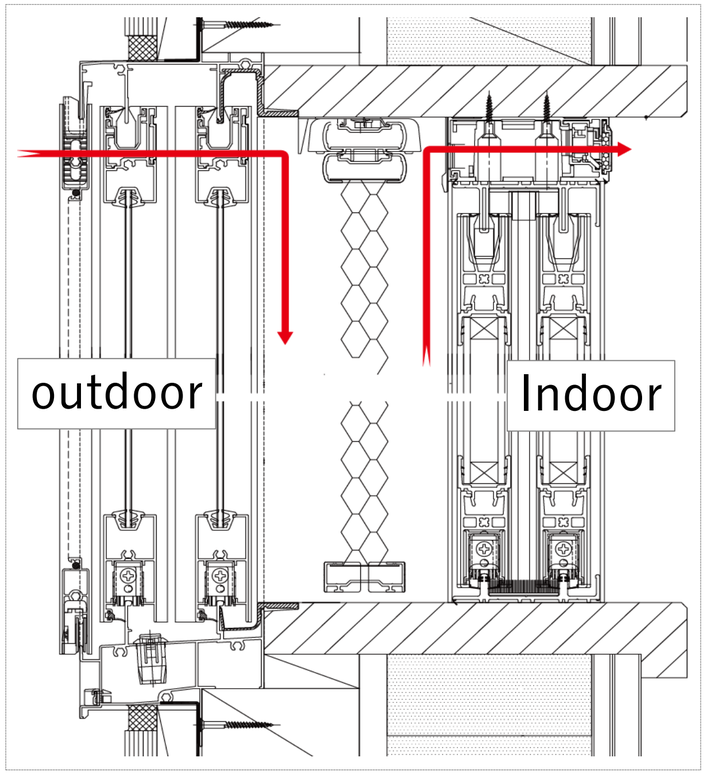

Figure 5 Window with DI technique applied

- Porous material is installed on the outer frame and the inner frame, and flow rate adjustment is possible
- From the stile portion of the outer upper side to the hollow layer, from the stile portion of the inner upper side to the interior
- · The combination of the outer window and the inner window is various
- · Install a blind in the hollow layer to secure a flow path

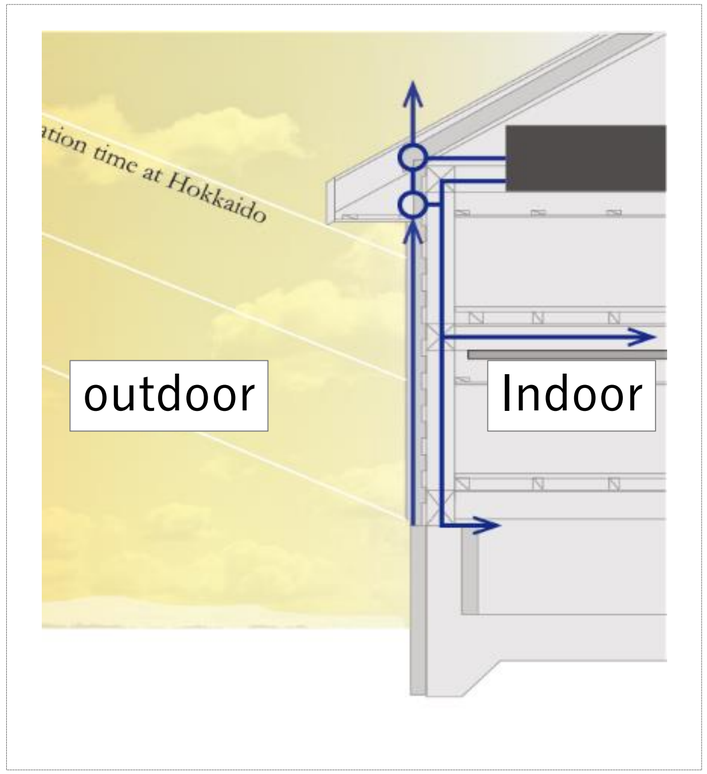

Fig. 6 Wall with DI technique applied

- Airflow in the gap between the furring edges
- Depending on the temperature of the ceiling, the flow path switches directly whether to take in indoor or through the total heat exchanger
- PCM is placed in the indoor side flow path, leveling the indoor side surface temperature

加藤研究室・大岡研究室・菊本研究室
Kato Lab., Ooka Lab., and Kikumoto Lab.

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Study on windows applying DI technology (comfort evaluation)

Study on windows applying dynamic insulation technology

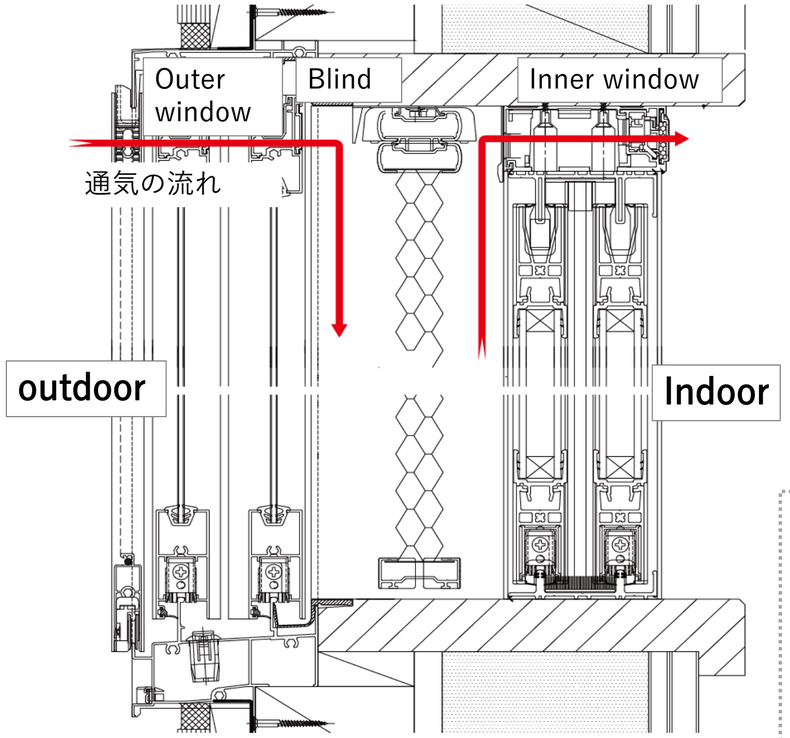

Figure 7 Sectional view of DI window

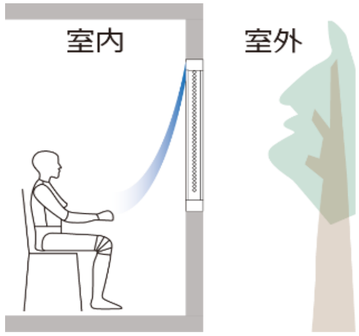

Figure 8 Image of DI window

【Measurement method】
The thermal manikin was placed in an actual house and the comfort was evaluated by the equivalent temperature.

【Result of measurement】
The closer the window is, the greater the cooling effect will be, but at the time of clothes the difference is small, the cooling effect is small.

- Deduction window machining existing window frame
- From the stile portion of the outer upper side to the hollow layer, from the stile portion of the inner upper side to the interior
- Install a blind in the hollow layer to secure a flow path

Figure 9 Thermal mannequin clothing sitting position

- Mannequin which generates heat like a human body
- The joint can be moved, the posture can be changed· Evaluate the influence of airflow at naked body

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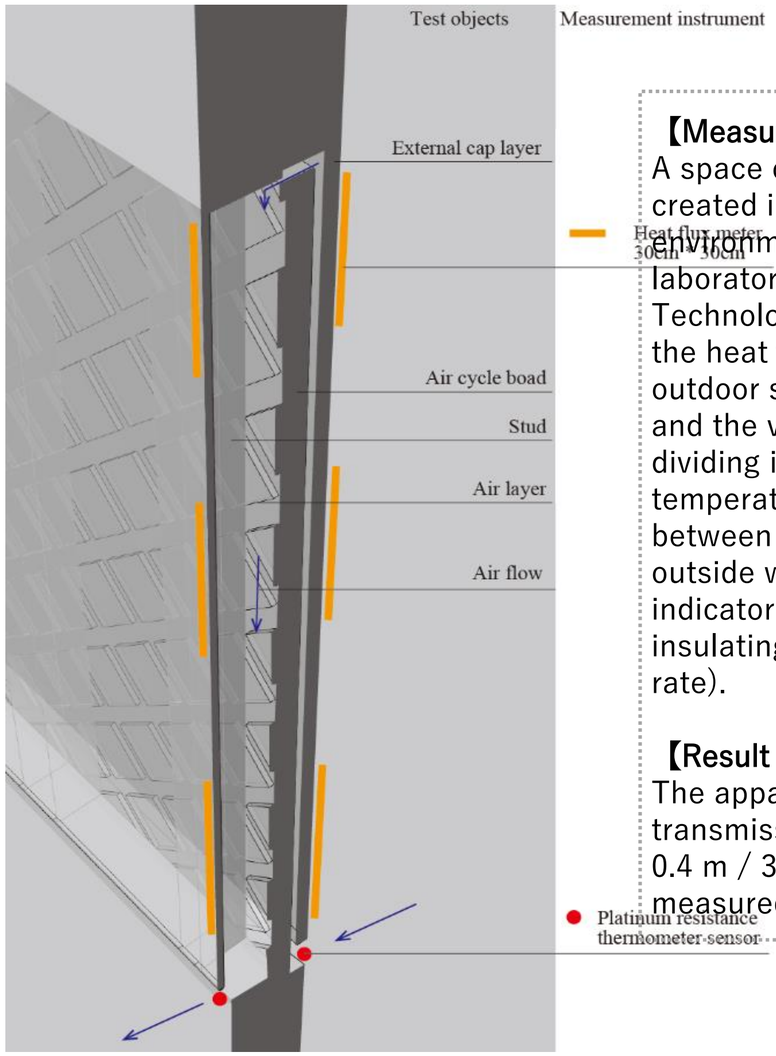
Study on wall applying DI technology (Evaluation of heat insulating performance)

Study on wall applying dynamic insulation technology



【Measurement method】
A space of -10 °Cwas created in the extreme environmental testing laboratory of the Production Technology Laboratory and the heat flux loss from the outdoor side was measured and the value obtained by dividing it by the temperature difference between the inside and the outside was used as an indicator of the heat insulating performance Flow rate).

【Result of measurement】
The apparent heat transmission coefficient at 0.4 m / 3 h of aeration was measured at 0.18 W / m ² K

Fig. 10 Measurement part and configuration at the time of insulation performance verification

Figure 11 Aeration layer of air cycle board

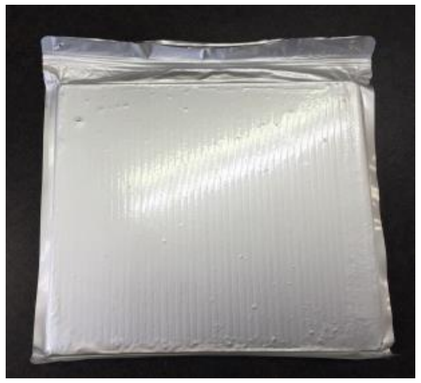
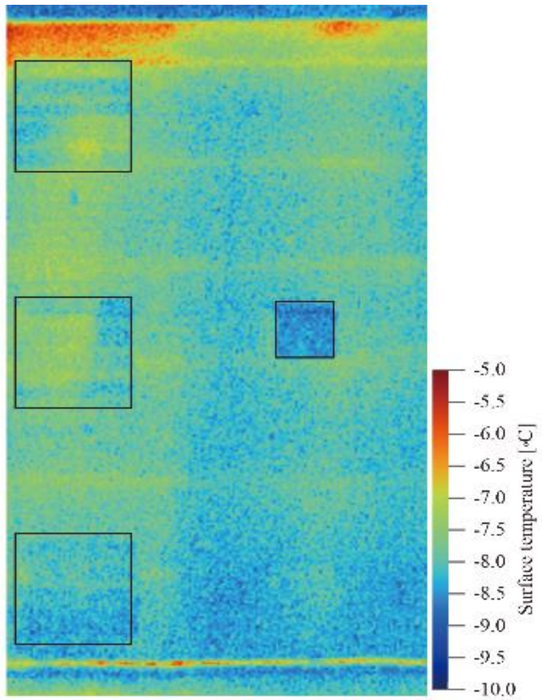


Fig. 12 Latent heat storage material (PCM)



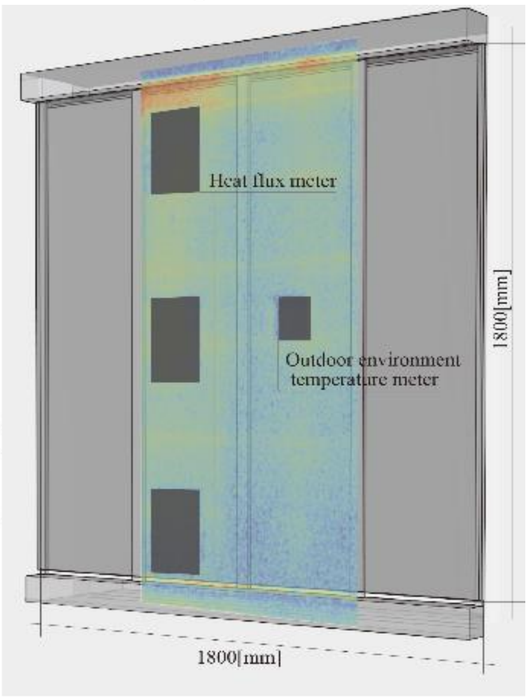


Fig. 13 Examination of outdoor side surface by thermal image