

Analysis of a Defroster

Dew condensation and evaporation on room window and wall are analyzed using scSTREAM

Analysis of an Electric Defroster

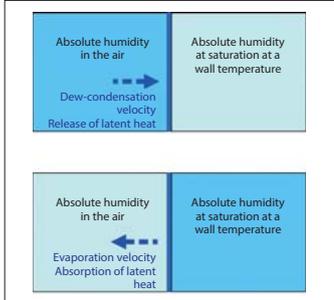


Figure 1: Dew condensation rate

Defroster is...

Function to remove car window frost caused by dew condensation.

Dew condensation analysis...

- Treats water vapor as a variable in the fluid analysis of the gas phase
- As shown in Figure 1, when the absolute humidity in the air is greater than the saturated absolute humidity at the wall temperature, dew condensation rate [kg/(m²·s)] rises and heat of 2,500 [kJ/kg] corresponding to the latent heat is generated.
- When the absolute humidity in the air is smaller than the saturated absolute humidity at wall temperature, evaporation rate, which is the negative dew condensation rate, rises and the heat corresponding to the latent heat is absorbed.

Analysis Model

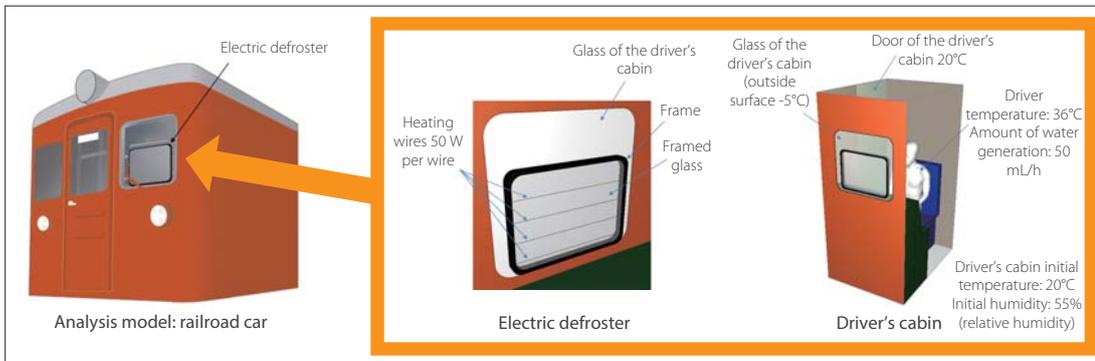


Figure 2: Railroad car

- Assume double-glazed glass window.
- Four heating wires are used and they start heating 90 seconds after the simulation starts. The heating rate reaches 100 W per wire in 10 seconds, and it is maintained thereafter.

Analysis Results

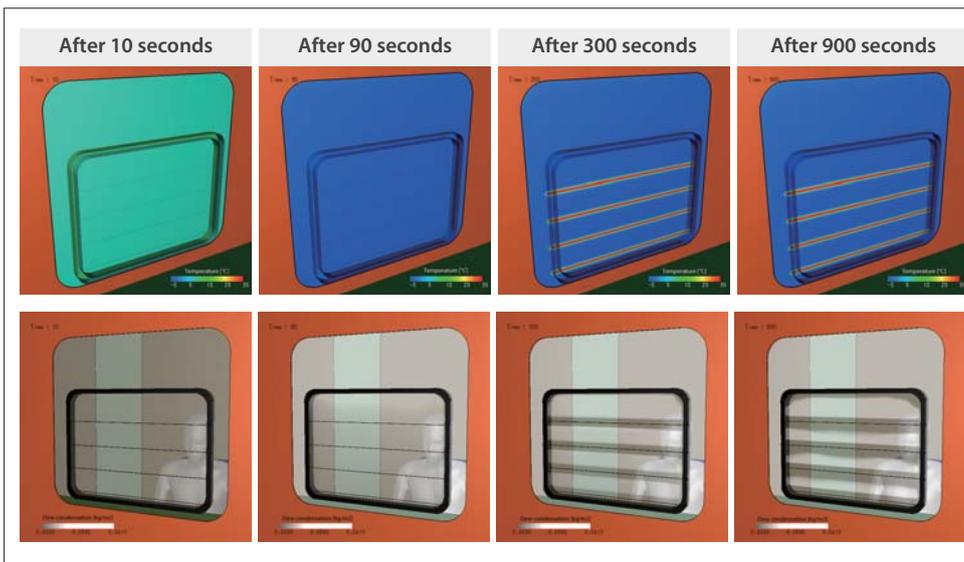


Figure 3: Temperature distribution of glass of the driver's cabin (above), dew condensation distribution (below)

Analysis target	Driver's cabin
Surface temperature	36 °C
Amount of water generation	9.0 × 10 ⁻⁶ kg/(m ² ·s) (50 mL/h)
Surface temperature	<ul style="list-style-type: none"> • -5 [°C] (outside drive's cabin window) • 20 [°C] (driver's cabin door) • The rest is adiabatic
Initial temperature	20 [°C] (driver's seat)
Initial humidity	55% (relative humidity) Consider buoyancy due to temperature difference

Notes

Dew condensation occurs on the glass of the driver's cabin window after 90 seconds after the start of calculation. Dew condensation is being removed as heat is generated from the heating wires.