

Thermal improvement of windows by using low-emissivity blinds

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Movable opaque layers in windows are often used to reduce overheating or glare. However, they can reduce thermal losses as well.

Nighttime insulating properties of standard passive-house windows can hardly be much improved by common blinds. But there is a possibility to use blinds whose emissivity is low. An easy, low-cost one: don't spoil the aluminium by a paint! Any paint has emissivity near to 0.9, a clean aluminium near to 0.1. By using aluminium with just a thin oxide layer, the radiative transfer on its both sides can be reduced to a fraction, and thermal properties of the window made substantially better; the outcome depends on air convection through and around the blind.

The best position of such a layer is between two low-iron glasses. With the blind open, the solar gains are maximized. In a closed state it reflects nine tenths of solar radiation outwards again (in hot summer days), and minimizes the outward heat flux through the cavity (in cold nights). Less ideal position is on the exterior side of a window; such shading devices are very common, but their possible influence on nighttime insulation properties are neglected.

The lecture will show the measurements of insulation properties in situ, by thermography, for a variety of window compositions. Any difference between two adjacent windows becomes readily visible. A method how to convert the displayed surface temperatures to a fair guess of "U-values" will be presented.

The main contribution will be a visualization that shading devices, which are anyway needed for comfort, can lower heat losses a lot. Optimizing their insulation properties brings another gain with it, namely reducing the solar overheating further, compared to conventional blinds (this will be shown too).

Low-e blinds can improve old windows to a twice better standard. Including sophisticated low-e blinds into new windows from the very beginning is a complication, which is worth it. It's similar to the case of advantages of mechanical ventilation with heat recovery... E.g., large windows can be used without fear, as protection against the sun or cold can be improved as needed.