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Study of thermochromic glass performance in the Danish climate and visual comfort perspectives

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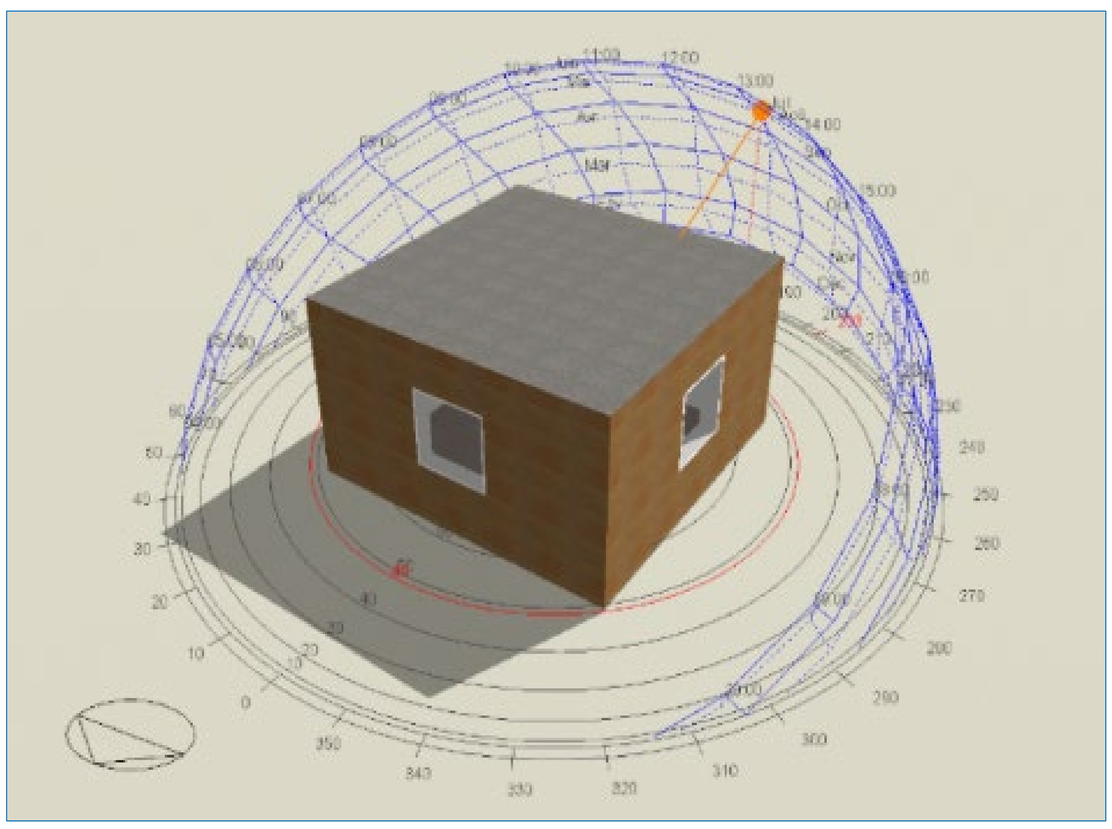
• Introduction

Windows are key elements in the building envelope in terms of energy performance and comfort. Thermochromic materials change their tint, visible-light transmittance and infrared transmittance as a function of temperature. They can be used to form dynamic façade elements for self-regulation of solar gains in order to avoid over-heating inside buildings.

The recent development of these so-called smart thermochromic glazings with the purpose of improving thermal comfort inside buildings raises the question of the visual comfort level offered by such glazings.

• Objectives

This numerical study investigates the indoor illuminance comfort level of thermochromic glazing systems under Danish climate conditions.



• Methodology

The indoor illuminance comfort level inside a Nordic building is simulated for 5 different commercial thermochromic glazing systems:

- Thermochromic Suntuitive® from Pleotint company
- 3 thermochromic glazing systems from Lawrence Berkeley National Laboratory
- Thermochromic Ravenbrick® from RavenWindow company

The numerical study was performed with DesignBuilder (EnergyPlus) Software on a one-room building model.

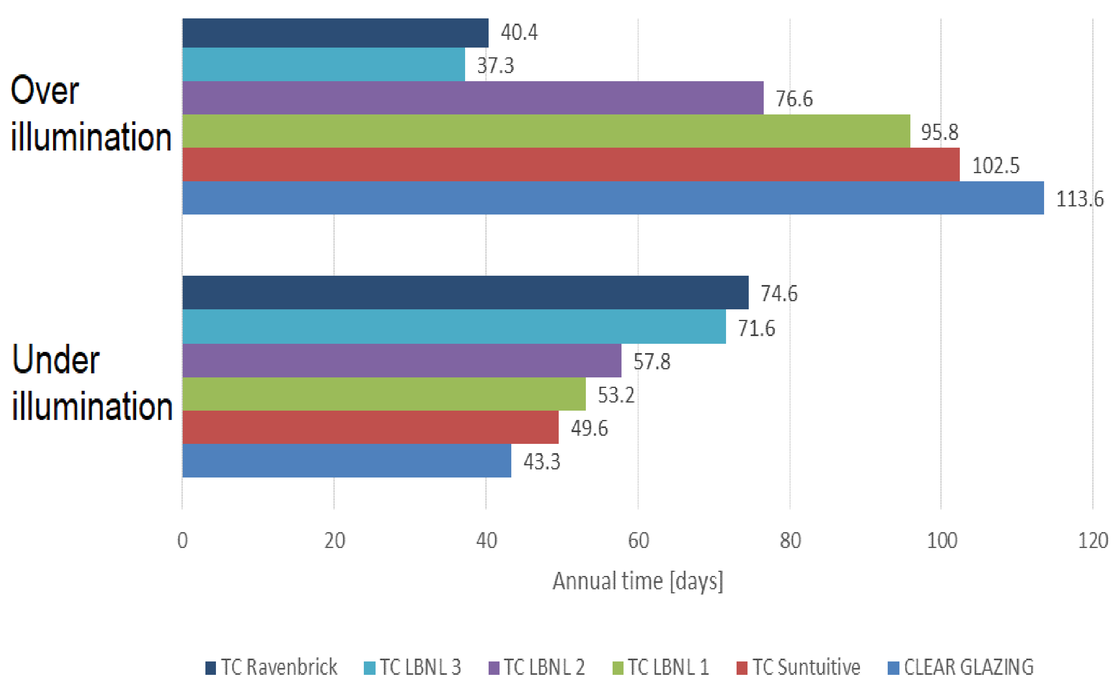
Glazing system	T_{int} transition state	T_{vis} in clear state
Thermochromic Suntuitive®	5 °C to 95 °C	$T_{vis} > 0.6$
Lawrence Berkeley National Laboratory 1	25 °C to 75 °C	$T_{vis} > 0.6$
Lawrence Berkeley National Laboratory 2	25 °C to 75 °C	$T_{vis} \sim 0.55$
Lawrence Berkeley National Laboratory 3	25 °C to 75 °C	$T_{vis} < 0.36$
Thermochromic Ravenbrick®	34 °C to 35 °C	$T_{vis} < 0.36$

• Results and conclusions

The thermochromic effect is not activated for a major part of the year because of the cold climate.

Thermochromic systems improve the visual comfort level and reduce glare discomfort by reducing over-lit annual time but increase the demand for artificial lighting.

Wind exposure driving convective heat transfer at the surface of the glazing systems, and sky conditions (cloud cover) have a major impact on the thermochromic glazing's response.



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