

SUMMARY REPORT

Title

TN technology for architectural applications

Motivation

Research and design have been underway for some time in the field of adaptive window elements for building envelopes. To achieve adaptive functionality these elements make use of smart materials. Though, the majority of commercially available switchable glazing systems do not meet all requirements in terms of switching speed, colour neutrality or temperature sensitivity.

On the other hand, large scale television displays based on liquid crystal technology are available. The simplest technology of grayscale displays is the twisted nematic liquid crystal cell (TN cell). A TN cell exhibits an extremely fast switching behaviour and a negligibly small colour distortion. A disadvantage of the TN cell is its low maximum transmissivity. The aim of the research project was therefore to clarify whether TN glazing systems can become an alternative to commercially available switchable glazing systems.

Objectives

In order to evaluate the application possibilities of the TN cell in façades, the determination of a suitable cell layout, the production of the switchable modules and their integration into an insulating glazing, as well as the characterization of the components of the TN cell, were carried out.

TN Modules of type GV66 were produced by the company BMG MIS GmbH Luminator Technology Group according to the specifications defined by the authors. Each pixel of the TN module has its own electrical supply line and may be driven in the "off" or "on" state. Different transmittance values of this type of glazing are to be achieved by displaying different image patterns. For further investigation of the influence on the indoor climate, the energy consumption for room conditioning, the daylight provision and the glare protection, an insulating glazing unit equipped with 45 TN modules has been implemented in the south façade of a test building at ILEK. The TN glazing was operated with a simple temperature-based control strategy. This allowed empirical investigations in the test room. The effectiveness of the glazing with regard to the light and energy transmission control as well as the glare prevention was determined.

Conclusion

The developed switchable glazing allows for separation of two important functions, glare protection and daylight provision, within one glazing element. Different areas of the glazing can be controlled independently and fast according to changing outdoor conditions. Due to the small-scale structuring in many individually controllable pixels, it is possible to display graphical contents and texts on the glazing.

The TN modules used in the research project do not yet have a sufficiently high filling factor that would completely eliminate glare effects. However, this can be achieved by modifying the arrangement and size of the pixels.

The results of the investigations on the long-term stability of cell components are promising with regard to façade exchange cycles of 15 to 20 years. The first cost estimation for the further production of TN glazing units shows their competitiveness to commercially available adaptive systems.

Despite further tasks to be solved, in comparison to conventional façade solutions, the switchable TN glazing developed within the research project has significant advantages. The integration of sun and glare protection functions, complemented with an effective controlling, is expected to lead to a remarkable indoor comfort improvement.

Basic information

Short title: TN glazing

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