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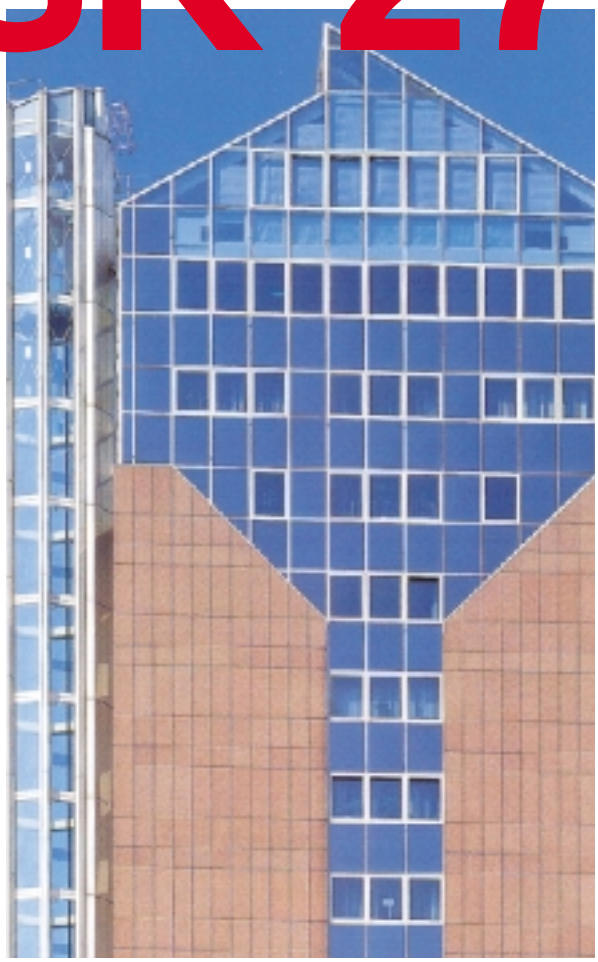
TASK 27



Performance, durability and sustainability of advanced windows and solar components for building envelopes

Solar Heating & Cooling Programme
International Energy Agency
Solar Heating & Cooling Programme

Performance of Solar Facade Components

We are living in period of innovation. New products for the building envelope are designed to improve comfort, appearance and the energy saving performance of buildings. Keywords are: solar gain and solar control, thermal losses, daylighting, multi-functional facades.

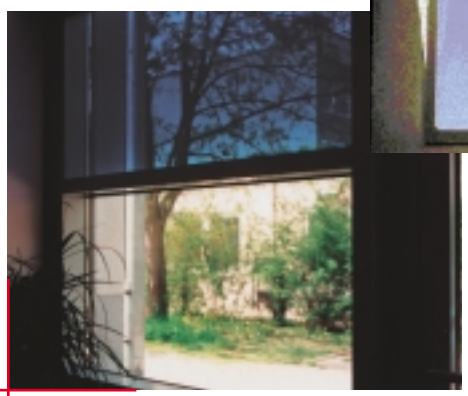
The frequency of innovation cycles is increasing rapidly and in addition, products with completely new functional properties and applications, like switchable glazings, have already been developed and are already entering the market. Methods for assessment of their performance are needed promptly.

The objectives of Task 27 in the Solar Heating and Cooling Programme of the International Energy Agency are to determine the solar, visual and thermal performance of materials and components, such as advanced glazing, for use in more energy-efficient, comfortable, sustainable buildings, on the basis of an application-oriented energy performance assessment methodology; and to promote increased confidence in the use of these products by developing and applying appropriate methods for assessment of durability, reliability and environmental impact.

Facade with transparent insulation (Fraunhofer ISE, Germany)

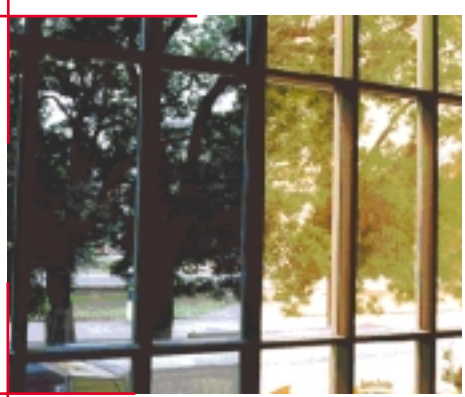
Front Page: Streamlines in a ventilated double facade (TNO, Netherlands) "Berliner Tor" in Hamburg, facade construction by Boetker GmbH, Germany

Electrochromic window (NREL, USA)



Gasochromic window (Fraunhofer ISE, Germany)

Glass pane with anti-reflective coating (Fraunhofer ISC, Germany)



Elektrochromic window (Flabeg GmbH, Germany)

TASK 27

Subtask A: Performance with respect to energy and comfort

Leader: Dick van Dijk , TNO, NL

Subtask A aims to bring together and further develop structured knowledge on the thermal and solar performance of windows and other solar building envelope components and their effect on energy consumption and thermal and visual comfort in the building.

In particular, emphasis is placed on the assembly and integration of high performance, novel and/or complex solar components into functional building envelope elements.

Those assemblies may incorporate highly insulating glazing/frames, chromogenic switchable glazing, solar shading devices, PV windows and other daylighting components.

The ultimate goal is to achieve coherent sets of widely applicable calculation methods supported by simple test methods, suitable for comparison and selection of solar façade products and for simulation of their energy and comfort performance in specific applications.

The work will directly support manufacturers in improving products and their characterisation and specification. Feedback on the needs from international standardisation, research and industry is ensured by the participation and contacts in the subtask, which is comprised of key persons from industries (glass, shading, façade), RTD teams and international standardisation.

Testfacility for solar facades (SPF, Switzerland)

Subtask B: Durability

Leader: Bo Carlsson, SP, Sweden

This subtask aims at the development of a general framework for durability test procedures and service lifetime prediction (SLP) methods that are applicable to a wide variety of advanced optical materials and components used in Energy Efficient Solar Thermal and Buildings applications.

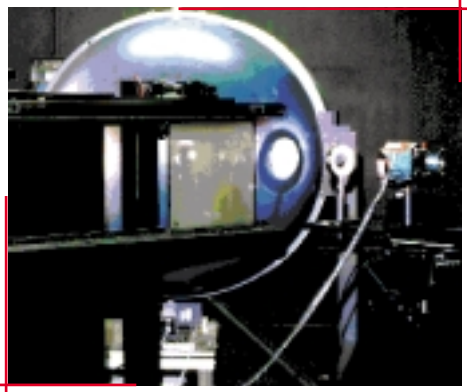
The appropriate durability test tools are also applied to specific materials and components in case studies to allow prediction of service lifetime and to generate proposals for international standards. The specific materials include:

- glazing incorporating electrochromic coatings, gasochromic coatings, and thermotropic materials
- anti-reflective and polymer glazing, reflectors, and solar facade absorbers

Expected deliverables will be

- A validated methodology for durability and lifetime assessment comprising standardised test protocols and data analysis procedures
- Durability, degradation, ageing and failure mode data and models for the selected materials
- Recommended test procedures for durability assessment and service life prediction of the specific materials selected

To achieve successful and sustainable commercialisation, solar building products must meet three important criteria, namely minimum cost, maximum performance, and demonstrable durability. Durability assessment directly addresses all three segments of this triad.



Optical characterisation with a large integrating sphere (ENEA, Italy)

Subtask C: Sustainability

Leader: Jean-Luc Chevalier, CSTB, France

Subtask C addresses the sustainability of solar building envelope components, concentrating on two main areas within the wide concept of sustainable development: environmental impact assessment and service life prediction by investigating and identifying relevant methodologies and criteria, and applying them to selected examples.

Environmental impact assessment will be based on existing knowledge within the participating countries regarding tools available, national actions and priorities, and needs expressed by the industry, and will proceed towards a harmonised format for communication on environmental characteristics.

The durability approach developed in Subtask B permits an assessment of estimated service lifetime at the material and product level based on their decreasing performance over time. However, premature failures of the products on the component or system scale must be considered in addition. The suggested methodology is the application of the Failure Mode Effects and Analysis tool, which will be adapted to a whole window, a transparent insulation element, a double façade unit and solar devices.

The complete reliability assessment of windows and glazing units is based on considering windows and solar components as systems, including the integration into the building construction. Accelerated indoor testing as well as outdoor long-term monitoring of a set of selected window systems yields data for the long-term performance and the hygro-thermal behaviour. Durability and reliability assessment procedures will be documented and processed to provide recommendations and guidelines.

Thermal properties of windows (VELUX, Denmark)