# PolyArch

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## Abstract

The challenge of the future is to minimize the energy consumption of buildings while maintaining an optimal comfort level in the interior. Controlling the energy streams in and out of the building , and especially daylight management, plays an important role. It deals with many, sometimes conflicting functions of the building:

Generally a maximum of natural lighting is desired to reduce the need for lighting energy which in today's buildings accounts for approximately 30% of the total electricity demand. But daylight contains a lot of energy. We need to block sun radiation in summer to prevent overheating, whereas in winter this incoming energy is desired to reduce the need for heating energy.

By means of the PolyArch project we aim at clarifying the energy savings potential as well as identifying the technological challenges that need to be tackled in order to get PolyArch market ready. Prototypes of the product will be displayed and tested in the LightVan, a mobile light laboratory.

## Keywords

coatings; responsive coatings; architecture; daylight; daylight management; natural light; overheating; design; energy saving; LightVan


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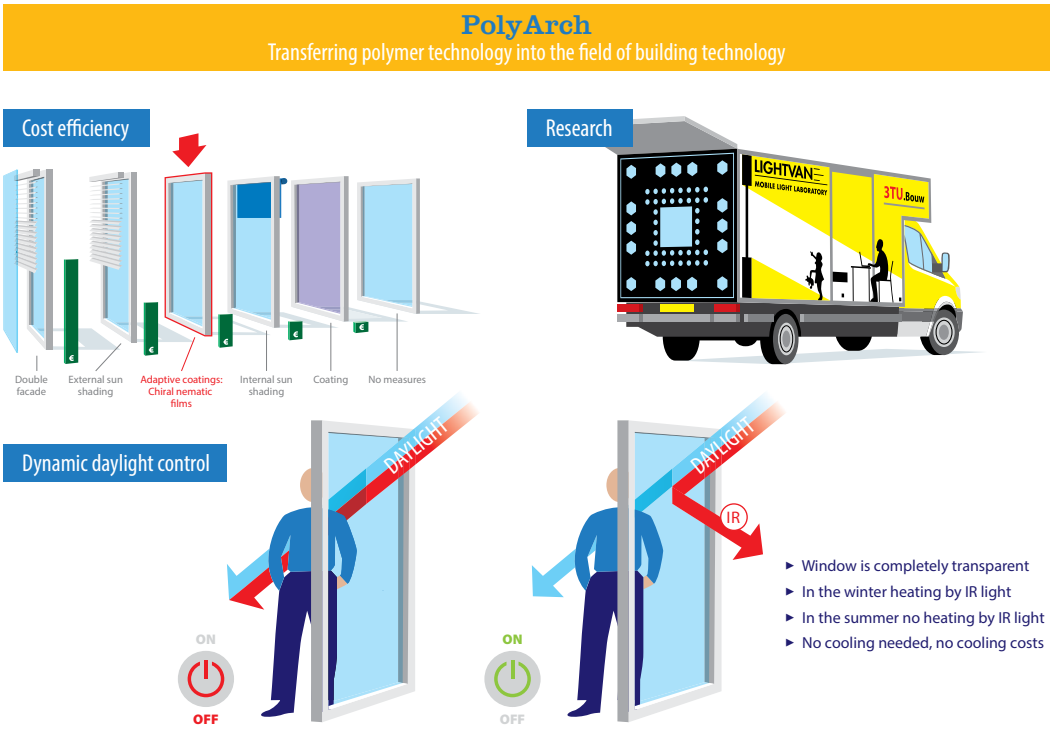


FIGURE 1 Graphical abstract

# Background

The challenge of the future is to minimise the energy consumption of buildings while maintaining an optimal comfort level in the interior. Controlling the energy streams in and out of the building, and especially daylight management, plays an important role. It deals with many, sometimes conflicting functions of the building: Generally a maximum of natural lighting is desired to reduce the need for lighting energy which in today's buildings accounts for approximately 30% of the total electricity demand. But daylight contains a lot of energy. We need to block sun radiation in summer to prevent overheating, whereas in winter this incoming energy is desired to reduce the need for heating energy

There are several traditional strategies to control daylight such as metallic coatings, exterior and interior sunshades. The existing daylight management strategies are rather inefficient or they involve considerable constructive effort, high investment costs and high maintenance and cleaning expenditures. On top of that the architectural impact of additional external or internal functional layers is big and they often do not meet the expectations of designers.


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# Concept

Our collaborating party, the Department of Functional Organic Materials and Devices at the TU/e is a leader in developing new responsive coatings. With these materials we will be able to switch physical properties such as colour, reflectance and heat transfer. For instance, responsive liquid crystal networks may adapt the degree of reflection. The position of the reflection band in the electromagnetic spectrum can be dynamically shifted in response to temperature or light. Reflection can be shifted in the near infrared part of the spectrum thus controlling heat flux without affecting transparency in the visible part of the spectrum. When applied on a glass window this film determines whether the heating part of sun light is being transmitted or reflected.

Since it is responsive, this technology will potentially deliver a much better performance than current static metallic coatings without the need for additional constructive effort for external sun shading devices. The impact of this new concept on the established building process is low and we can expect a high acceptance by decision making parties. Responsive coatings have a great potential on the nanoscale in relation to traditional technologies for daylight management.

# Follow-up

Over the past two years we have been discussing with numerous stakeholders the possibility of applying responsive polymer based technology in the field of building. This has been done in several workshops and individual meetings In other disciplines, such as LCD screens and automotive industry similar technologies have been successfully applied.

With this proposal we aim at clarifying the energy savings potential as well as identifying the technological challenges that need to be tackled in order to get PolyArch market ready. Prototypes of the product will be displayed and tested in the LightVan, a mobile light laboratory.


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