The MorphoColor® Concept for Colored Photovoltaic Modules

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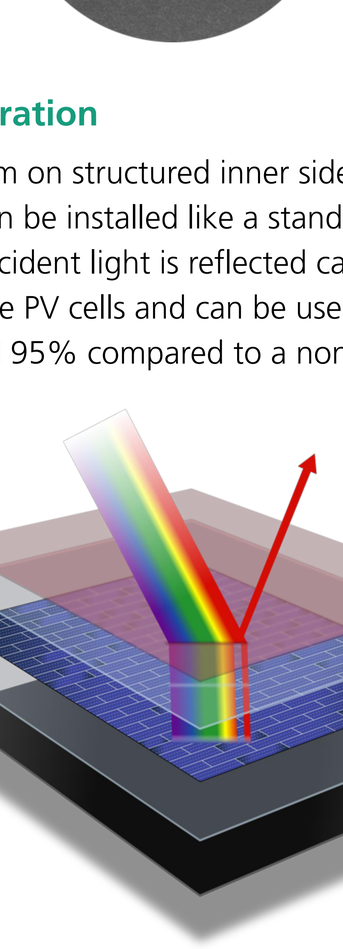
A massive expansion of installed photovoltaic (PV) capacity is necessary worldwide. The area of around 1640 km² (~Hamburg & Berlin) required in Germany by 2040 can be provided on buildings[1,2]. A visually appealing integration of PV systems is the key to successful implementation.

Requirements for Colored PV

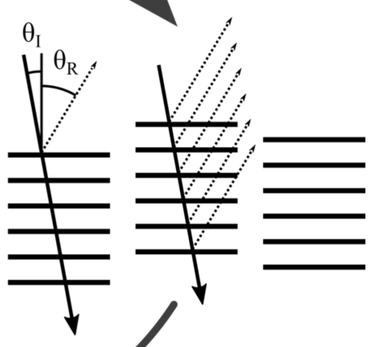
1. Low power losses for the PV system
2. Angular stable color appearance
3. Beautiful saturated colors

Inspired by Nature

Tree-like structures on the wings (SEM: Eye of Science)



Model to explain the Morpho effect according to Kinoshita et al.[3,4]



Blue butterfly of the genus Morpho (Image: Izzy LeCours)

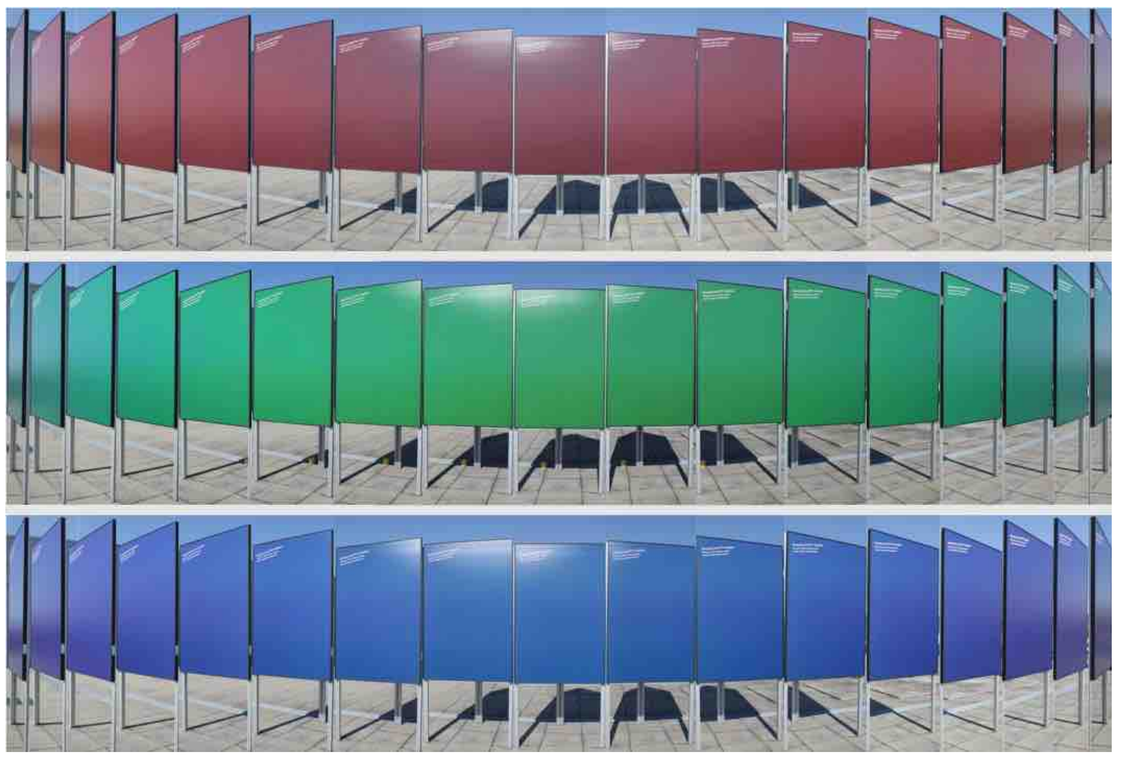
Reproduction of the effect using a Bragg reflector on structured glass (SEM from: Bläsi et al.[5])

Basic Principle of Operation

- Interference layer system on structured inner side of module cover glass
- MorphoColor® glass can be installed like a standard glass
- A narrow part of the incident light is reflected causing the color appearance
- The majority reaches the PV cells and can be used to generate electricity
- The efficiency is around 95% compared to a non-colored reference module

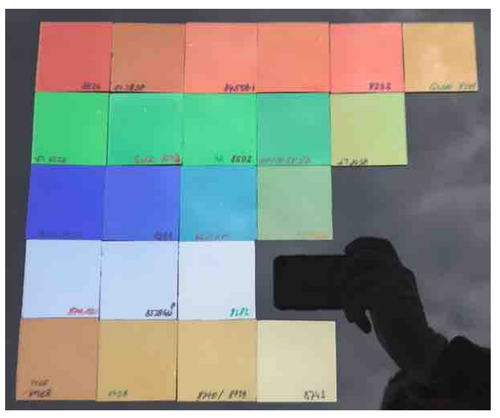
Perfect Angular Stability

1× 1,6 m² MorphoColor® modules at angles of up to 80° in direct sunlight



Wide Choice of Colors

- The color can be controlled by simply changing the layer thicknesses of the interference filter produced by sputter coating
- In addition to the rainbow colors, for example, gray and gold were also realized. Due to the more broadband reflection, the losses are slightly higher here.



First Pilot Installations

1 H. Wirth, Aktuelle Fakten zur Photovoltaik in Deutschland (2023)
2 K. Fath, Dissertation KIT (2017)
3 S. Kinoshita et al., Forma 17 (2002)
4 S. Kinoshita et al., Rep. Prog. Phys. 71 (2008)
5 B. Bläsi et al., IEEE J. Photovoltaics 11 (2021)

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