INNOVATION PARTNERSHIPS
UNIVERSITY OF MICHIGAN

Decorative Semi-Transparent Photovoltaics Creating Angle Insensitive Transmissive Colors

TECHNOLOGY NUMBER: 6012

OVERVIEW

Angle-insensitive decorative photovoltaic panels with color transparency

- Generates energy while maintaining consistent color under various incident angles
- Building integrated photovoltaics, decorative glass panels, greenhouse roofs

BACKGROUND

The integration of solar panels into building infrastructure has always been a subject of significant interest. Previous attempts, such as dye-sensitized (DSSC) and organic photovoltaics (OPV), provided solutions but had limitations in color tunability and transmission quality. DSSC heavily depended on dyes which caused color scattering, while OPV's flat absorption hindered broad color variations. Conventional thick amorphous silicon panels also remained inefficient at creating desired color outputs due to their black appearance. There was a pressing need for photovoltaic technology that offered both efficient energy harvesting and aesthetically pleasing color transmission that remained consistent at varying angles of incidence. Hence, the development of a new design demonstrating both power generation and decorative functionalities became essential for modern architectural applications and energy sustainability.

Technology ID

6012

Category

Hardware

Engineering & Physical Sciences

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INNOVATION

Researchers at the University of Michigan have developed ultra-thin (6 to 31 nm) undoped amorphous silicon (a-Si)/organic hybrid solar cells that produce angle-insensitive transmissive colors. This hybrid structure, utilizing metal oxide and organic interfacial charge transport layers, minimizes electron-hole recombination in the ultra-thin a-Si, achieving high power conversion efficiency up to 2%. The design offers resonant optical transmission, providing distinct colors without the shift in wavelength with changes in incident light angle. This characteristic is particularly beneficial for building-integrated photovoltaics, decorative glass applications, and greenhouse roofs.

ADDITIONAL INFORMATION

REFERENCES:

Lee, J., Lee, KT., Seo, S. et al. Decorative power generating panels creating angle insensitive transmissive colors. Sci Rep 4, 4192 (2014). https://doi.org/10.1038/srep04192

INTELLECTUAL PROPERTY

US10580918 "Decorative dual-function photovoltaic devices generating angle insensitive transmissive or reflective colors"