

**Title:****Butterfly Wing Scales as Inspiration for Multifunctional Building Surfaces****Authors:**

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**Abstract:**

Global warming advances and urban areas are plagued by increasingly intense heat waves every summer, pressing a dire need to cool down cities.

Butterflies can inspire us in this matter, as they benefit from various multifunctional nanostructures on their wing scales. The properties range from structural coloring, hydrophobicity and self-cleaning properties to structural integrity and passive thermoregulation. Recent research on scent scales - special scales, used by butterflies to distribute pheromones - indicates that they exhibit interesting thermal properties, especially within the atmospheric window (the wavelength spectrum from 7.5  $\mu\text{m}$  - 13  $\mu\text{m}$ , where our atmosphere is transparent for radiation within that range).

This work aims to investigate different kinds of butterfly scales on a micrometer and nanometer scale for potential application in the thermoregulation of buildings.

With Scanning electron microscopy (SEM) and Focused ion beam (FIB) techniques it is managed to cut into single scales, to analyze the cross-section of these structures and to provide first expert guesses about structure-function relationships. Color scales, scent scales and reflective scales from various butterfly species (both tropical and native to the temperate zone of Middle Europe) are compared, to determine, whether specific nanostructures could be responsible for thermal features such as passive radiative cooling.