Utilizing passive radiative properties of Silver Ants

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Abstract

The increasing occurrence of hot summer days causes stress for both humans and animals, particularly in urban areas where temperatures remain high even at night. Nature offers potential solutions that require minimal energy and material costs. For instance, the Saharan Silver Ant can endure the desert heat by means of passive radiative cooling induced by its triangular hairs. Shi et al.[1] experimentally demonstrated this effect. The aim of this project is to transfer the structural cooling property of the Ant to various surfaces by using an epoxy mould or stamp. Shrimp shells are chosen as the first target surface due to their low cost (as a waste product), biodegradability, and similarity in material to the ants' bodies (Chitin). In the initial phase of the project, shrimp shells are scratched with a diamond tip. Some of the samples are subjected to simulated hot and cold climates inside a climate chamber for three weeks. Comparing the exposed to the unexposed samples provides insight into the weatherability of the shells. The measurements are carried out with optical, confocal and electron microscopy. In the second part, a stamp of the Silver Ants surface is manufactured using the process described in the paper by Zobl et al.[2] This Stamp is used to modify the shrimp shell surface, with the aim to increase its emissivity. We want to show, that it is possible to decrease the surface temperature purely through functionalities induced via structural modification. This shall then be scaled up for larger surfaces, such as house facades, to reduce the need for conventional cooling.

[1] Keeping cool: Enhanced optical reflection and radiative heat dissipation in Saharan silver ants. Shi, 2015, DOI: 10.1126/science.aab3564

[2] *Morpho peleides* butterfly wing imprints as structural colour stamp. Zobl, 2016 DOI: 10.1088/1748-3190/11/1/016006