SURFACE COLOR ON DEMAND: Chameleon Effect

Karine MOUGIN[1], Feriel GHELLAL[1], Quentin BAUERLIN[1], Arnaud SPANGENBERG[1]

[1] Institut de Science des Matériaux de Mulhouse, Mulhouse, France
(corresponding author: karine.mougin@uha.fr)

ABSTRACT:

Colors affect our everyday life as they provide critical functions in both recognition and communication. Nearly all artifacts of our everyday are manufactured from polymers colored by dyes. This approach allows an endless variety of colors. And yet, **each individual item** is produced in **one** color, which cannot be changed after its production. This is a serious problem for manufacturers, as some goods cannot be sold anymore when their color is outdated. This issue can also cause **tremendous costs** and **waste** if products cannot be recycled and have to be deposed. *So, it is of **high interest** to **add color-changing surfaces** to the portfolio of manufacturing.* In nature, changing colors are frequently observed in the animal's world for camouflage by misleading natural enemies or for courting by standing out from the environment. The most prominent examples are chameleons that are able to exhibit complex and rapid color changes during social interactions due to dispersion/aggregation of pigment within dermal chromatophores. A direct copy nature is not typically practical for everyday items but is **the inspiration of our approach to create color change in polymeric material [1].**

The idea was to create a novel hybrid material able to color change of surfaces at will. The key element of this novel technology is based on plasmonic. The developed functional nanomaterial is composed of colloidal metallic nanoparticles (NPs) that are properly synthesized and assembled into matrix to ensure a variety of plasmonic colors under mechanical stresses. **By changing height and width of a polymer film and/or the size of nanostructures through the shape memory effect, the distance between the nanoparticles are modified inducing a color change in the composite material [2].**

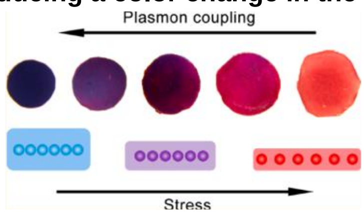

Figure 1: **Basic principle of a colorimetric stress memory sensor developed by Han et al. [2]. Gold nanoparticle chains embedded in a polymer matrix. Applying stress to the film increases the distance of the gold nanoparticles resulting in a color change of the sample. (Reproduced from [1])**

References

1- Mougin K, Hoel (2022) JOM under publication
2- Han X, Liu Y, Yin Y (2014), Nano Letters 14, 2466-2469