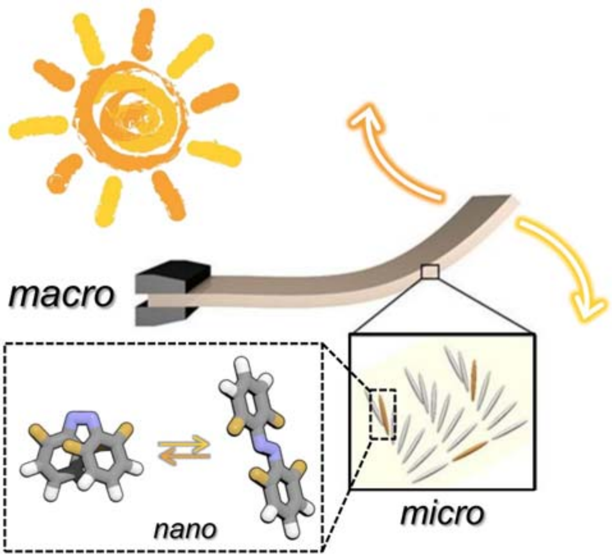
Tapping the sun

A team of researchers from **IRIS Adlershof** of the Humboldt-Universität zu Berlin and Technische Universiteit Eindhoven in the Netherlands have developed thin plastic films, which continuously move upon exposure to sunlight. These materials are able to convert the sunlight's energy directly into motion and have great promise for the development of sun-driven active coatings and surfaces, for example self-cleaning windows. These results have been published in Nature Communications.



Converting sunlight directly into motion by organizing light-responsive molecules
Figure: Dr. David Bléger

In order to harvest and utilize the sun's energy, alternative strategies to circumvent issues with energy storage and directly convert it into mechanical work have been developed over the years. A promising approach has been the design of light-driven molecular systems and machines; however, the collection of the individual molecules' response and subsequent amplification to macroscopic motion and mechanical work has proven difficult. Furthermore, previous systems required the use of intense high-energy UV light and therefore displayed poor performance in the context of solar energy conversion.

Now a team of German and Dutch chemists combined their expertise and took advantage of specific tetrafluoroazobenzene dyes, which undergo an efficient shape change upon exposure to visible green and blue light, and organized them into ordered liquid crystalline arrays. Fixing the ordered arrangement by polymerization yielded thin plastic sheets, which bend and chaotically oscillate in sunlight.

By carefully investigating the individual parameters of the system, the researchers found that the degree of oscillation depends on both the intensity and wavelength of the light and only occurs if both colors, i.e. blue and green triggering the opposite photoreactions, are present. As a result chaotic, macroscopic motion can be realized using "normal" sunlight, without the aid of specific optics or artificial light sources.

The authors foresee immediate practical outdoor applications including self-cleaning coatings and surfaces, for example in windows. In general, these findings should be of great importance for the development of autonomous, sunlight-driven nano- and micromachinery.

A chaotic self-oscillating sunlight-driven polymer
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