Atomically engineered interfaces improve electrostriction in an oxide material

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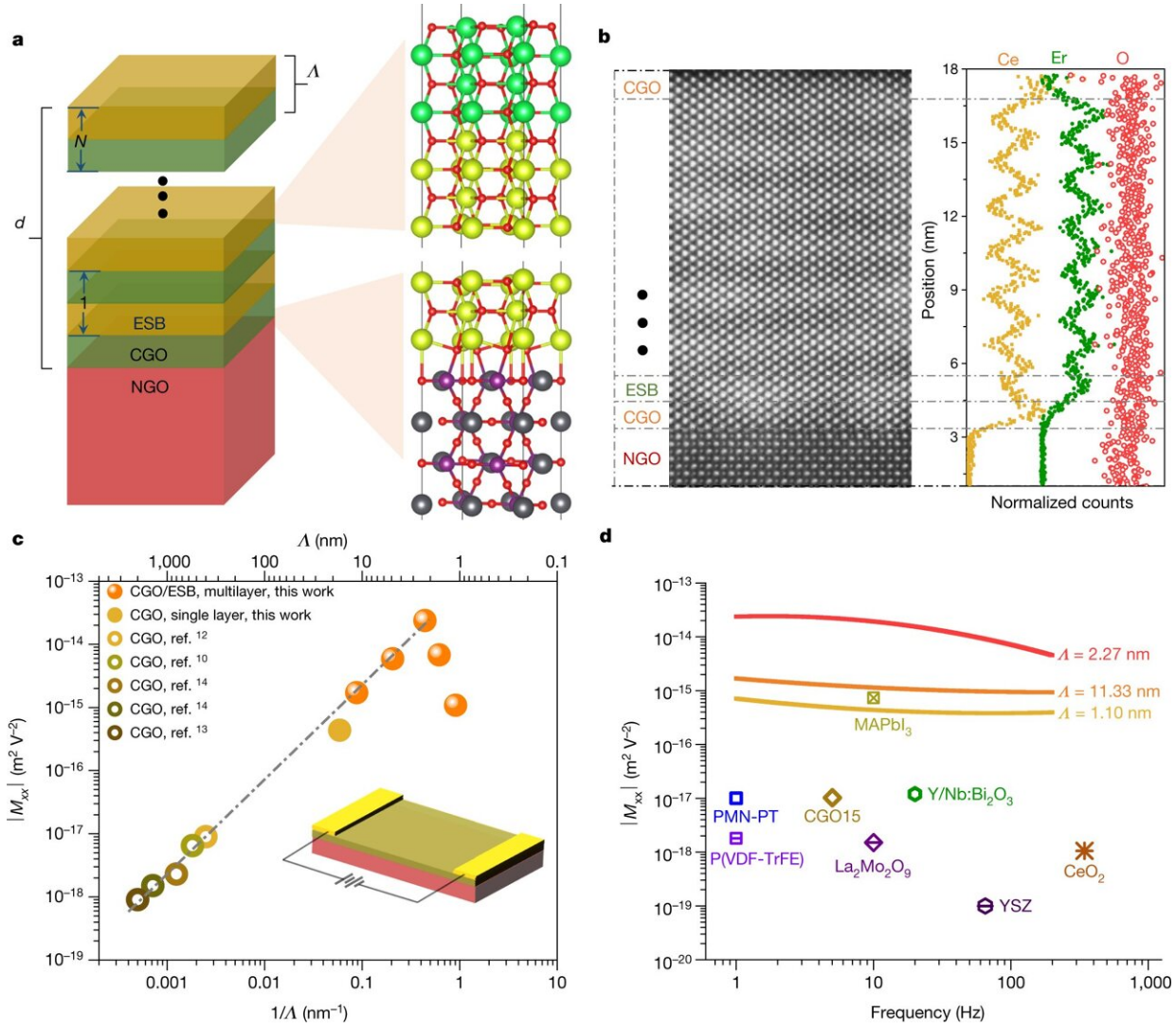

Multilayer structure and electrostrictive property of NGO/CGO/[ESB/CGO]$_n$. Credit: *Nature* (2022). DOI: 10.1038/s41586-022-05073-6

An international team of researchers has found a way to improve electrostriction in an oxide material by atomically engineering the interfaces of the layers of which it is made. In their paper published in the journal *Nature*, the group shows that electrostriction in oxides can be enhanced through the use of artificial interfaces. David Egger with the Technical University of Munich, has published a News & Views piece in the same journal issue outlining the work done by the group on this new effort.

Prior research has shown that applying an electric field to a material can sometimes result in desired modifications to the shape of the material—a phenomenon known as electrostriction. It has been used to great effect in creating motors and actuators. Formally, it is described as the process of generating strain in a material through application of an electric field. Unfortunately, most such applications involve the use of lead, which is toxic, so researchers have been looking for other materials.

One such promising possibility involves the use of tailored oxides, though the tailoring has not yet been worked out. In this new effort, the researchers report a big step toward that goal. They found a material made by layering different oxides in particular ways can improve the degree of electrostriction that results.

The work involved applying extremely thin (nanometer scale) layers of different kinds of oxide films, one on top of the other, to create a material. They repeated the process, varying the thickness and number of layers, each time measuring its electrostriction coefficient, and were able to make gradual improvements. They were able to create a material that had an electrostriction coefficient that was 1,500 times that of other oxides.

They report that the thickness of the layers was the most critical factor.

Making them thinner, they found, led to atomic processes between two layers that couple electrical and mechanical effects. The researchers also found that adding strain to the materials had a pronounced impact on electric dipoles within them, making them stronger and easier to orient.

More information: Haiwu Zhang et al, Atomically engineered interfaces yield extraordinary electrostriction, *Nature* (2022). DOI: 10.1038/s41586-022-05073-6

David A. Egger, Interfaces boost response to electric fields in layered oxides, *Nature* (2022). DOI: 10.1038/d41586-022-02948-6