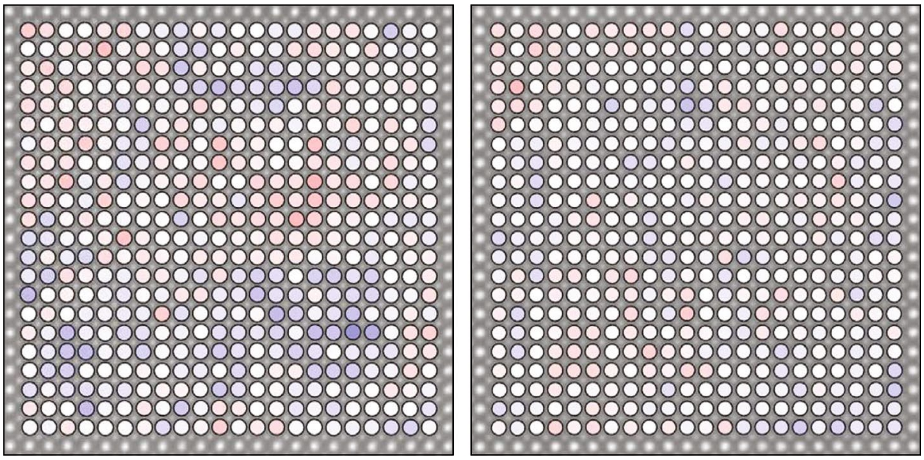
PEROVSKITE OXIDES

Piezoelectrics mix it up

Science **364**, 264–268 (2019)



Credit: AAAS

Piezoelectric materials can convert mechanical energy into electricity and vice versa (that is, mechanically deforming under the application of an electric field). They are commonly used in sensors, transducers and actuators with applications that range from energy harvesting to medical imaging. One piezoelectric material that has been well-studied in the past two decades is $Pb(Mg_{1/3}Nb_{2/3})O_3$-$PbTiO_3$ (or PMN-PT). Fei Li, Shujun Zhang and colleagues have now found a way to increase the piezoelectric coefficient of PMN-PT to around 4,000 picocoulombs per newton — twice as high as the best PNM-PT materials.

The researchers— who are based at various institutes in China, the US and Australia — found that adding trace amounts of samarium to PMN-PT can improve piezoelectric and dielectric performance. The origin of the increase in piezoelectric coefficient and dielectric permittivity, which is around 12,000 times the permittivity of free space — is attributed to a rise in nanoscale structural heterogeneity. Using atomic-resolution high-angle annular dark-field imaging in a scanning transmission electron microscope, Zhang and colleagues observe a greater spread of the atomic column distances (structural fluctuations) in samarium-doped PNM-PT compared to undoped samples. This growth strategy also enlarges the usable portion of the as-grown crystals, which should lead to reductions in the cost of piezoelectric devices.

Michael Lee

Published online: 17 May 2019
https://doi.org/10.1038/s41928-019-0253-y