Small and stable ferroelectric domains

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Researchers are one step closer to figuring out a way to make nano-sized ferroelectric domains more stable, reports a new study in journal *Science*.

Ferroelectric domains are tiny regions of a ferroelectric material where the electric polarization (the response of individual electric charges to an electric field) points in different directions.

Ferroelectric materials, which possess spontaneous and reversible locally polarized domains, are being used in many applications in electronics and optics.

Nano-sized ferroelectric memory devices are particularly attractive because they are sturdy, non-volatile, and use little power – ideal memory for use in smart cards, cell phones and other everyday devices.

In ferroelectric memory, information is stored and read by switching and detecting the polarization orientation in the ferroelectric material.

An ongoing challenge to making the domain sizes smaller is that the domains can spontaneously depolarize causing a loss of memory.

Theory suggests that under certain conditions, the domains can be stabilized through the gradual and continuous rotation of the polarization dipoles.

Here, Chulin Jia and colleagues use high-resolution electron microscopy techniques to observe the continuous rotation of dipoles to form a closed

loop in a ferroelectric material.

The results suggest that there are ways to make small patterned nano-ferroelectric materials more reliable for use in non-volatile memory devices.

More information: "Direct Observation of Continuous Electric Dipole Rotation in Flux-Closure Domains in Ferroelectric Pb(Zr,Ti)O3," by C.-L. Jia et al., *Science* (2001).

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