Reaction kinetics drive chiral nanocrystal formation in tellurium atoms

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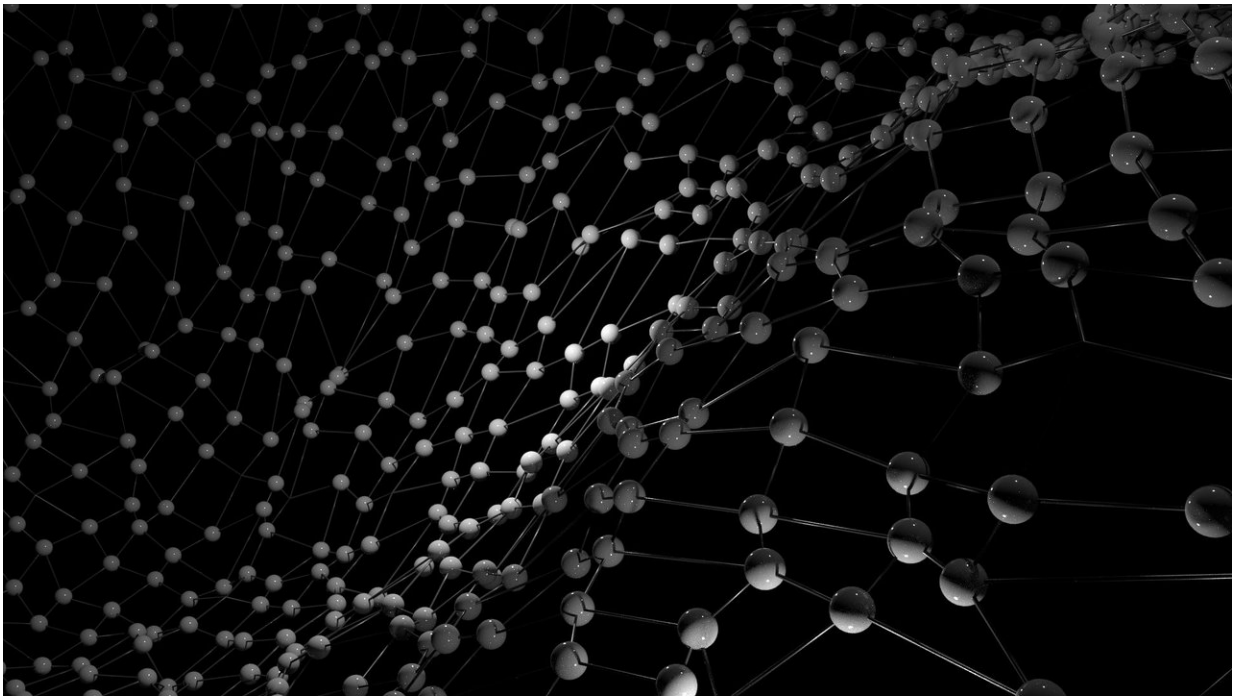

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A team of researchers from Ernest Orlando Lawrence Berkeley National Laboratory, the University of California, Berkeley, the University of Birmingham, Edgbaston, the University of Washington and the Kavli Energy NanoScience Institute has found that reaction kinetics are the factors that drive chiral nanocrystal formation in tellurium atoms. In their paper published in the journal *Science*, the group describes

preparing Te crystals in different ways and then watched what happened to them under a microscope. Inna Popov with the Center for Nanoscience and Nanotechnology, at the Hebrew University of Jerusalem, has published a Perspectives piece in the same journal issue outlining recent research into the means by which chiral compounds form chiral crystal shapes and also gives an overview of the work done by the team in this new effort.

Chirality is a term that describes a property of a mirrored structure, in which the mirror image of one cannot be superimposed on the other. An example would a simple pair of gloves. They mirror one another, but the left-hand glove will not fit correctly on the right hand and vice versa. A chiral object and its mirrored object are together known as enantiomorphs. An achiral object, on the other hand, is a mirrored structure in which the two can be superimposed on one another. One area of research involving chirality centers on crystal structures—scientists still do not fully understand how molecular chirality is involved in the formation of chiral crystals. In this new effort, the researchers sought to learn more about chiral crystal formation in one special case—in the element tellurium.

To learn more about chiral Te crystal formation, the researchers first prepared Te crystal samples by reducing the oxide they contain using hydrazine along with either achiral mercaptopropionic acid or chiral L- or D-penicillamine. The samples were prepared at different saturation levels as a way to study the different effects they would have on the chirality of the resulting crystals.

The researchers found that crystals prepared with medium saturation levels grew into chiral crystals regardless of the ligand used. But they also found that those prepared with high saturation levels grew into achiral shapes, even when prepared with chiral ligands. The researchers suggest that reaction kinetics are a major driver of lattice chirality in

tellurium.

More information: Assaf Ben-Moshe et al. The chain of chirality transfer in tellurium nanocrystals, *Science* (2021). DOI: 10.1126/science.abf9645

Inna Popov. Is chiral crystal shape inherited or acquired?, *Science* (2021). DOI: 10.1126/science.abh1213