New clues about an elusive material: A superconductor that can be synthesized in the lab
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Charles Ahn, the John C. Malone Professor of Applied Physics and department chair. "We find that it is very close to the superconducting behavior of titanium metal itself."

TiO is made up of a single oxygen that binds in between the titanium atoms. Conventional thinking predicts that the bond between titanium and oxygen is responsible for much of the material's interesting physics, but a closer look reveals that the titanium itself is a key driver for the electronic properties.

One reason TiO hasn't been studied more is because it's so difficult to get high-quality samples. Using a material growth method known as molecular beam epitaxy, however, the research team is able to synthesize a high-purity sample of the material to study.

"Compared to other growth methods, molecular beam epitaxy is flexible enough to stabilize phases that can't be synthesized any other way," Lee said.

Once they had a high-purity sample, they used a number of experimental and theoretical techniques to study it and acquire information about its electronic behavior and structure.

"By combining all of the experimental data with theory, we are able to determine that the very interesting superconducting behavior comes from the nature of the titanium-titanium bond in this material.

Now that they've synthesized TiO, Lee said there are numerous pathways to elucidate the relationship between the structure and electronic behavior of other similar classes of superconducting oxide materials.

"It reveals many important directions that the..."
community can take," he said.


Provided by Yale University


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