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In Brief: Nanodots to the rescue

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By applying the magnetic properties of iron nanodots to complex materials, a research team has overcome an obstacle to getting ultra-thin or highly strained films to perform on par with their bulk counterparts.

If the researchers are indeed successful, this work sets the stage for these exotic materials to be used in a wide range of fascinating and potentially technologically revolutionary applications, said Oak Ridge National Laboratory's Zac Ward, lead author of a paper published in Physical Review Letters.

The problem lies in the fact that at low dimensions or when the material is under strain it loses the characteristics that make it valuable for use in nano-scale electronics.

"What we discovered is a way to activate these materials using the magnetic properties of iron nanodots to control the electron spin and tune the behavior," Ward said.

More information: Tuning the Metal-Insulator Transition in Manganite Films through Surface Exchange Coupling with Magnetic Nanodots, Phys. Rev. Lett. 106, 157207 (2011)
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Abstract
In strongly correlated electronic systems, the global transport behavior depends sensitively on spin ordering. We show that spin ordering in manganites can be controlled by depositing isolated ferromagnetic

nanodots at the surface. The exchange field at the interface is tunable with nanodot density and makes it possible to overcome dimensionality and strain effects in frustrated systems to greatly increasing the metal-insulator transition and magnetoresistance. These findings indicate that electronic phase separation can be controlled by the presence of magnetic nanodots.

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