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Tuning Molecule-Mediated Spin Coupling in Bottom-Up-Fabricated Vanadium-Tetracyanoethylene Nanostructures XIAOWEI ZHANG, DANIEL WEGNER, RYAN YAMACHIKA, YAYU WANG, University of California, Berkeley and Lawrence Berkeley National Laboratory, TUNNA BARUAH, University of Texas, El Paso, MARK PEDERSON, Naval Research Laboratory, BART BARTLETT, JEFFREY LONG, University of California, Berkeley, MICHAEL CROMMIE, University of California, Berkeley and Lawrence Berkeley National Laboratory — We have fabricated hybrid magnetic complexes from vanadium atoms and tetracyanoethylene (TCNE) ligands via atomic manipulation with a cryogenic scanning tunneling microscope. Using tunneling spectroscopy we observe spin-polarized molecular orbitals as well as a structure-dependent Kondo resonance. For complexes having two V atoms, the Kondo behavior can be switched on and off by a minute structural change, even as the spin-containing orbitals remain unchanged. This can be explained by variable spin-spin (i.e., V-V) ferromagnetic exchange coupling through the TCNE molecule, as supported by density functional calculations. These findings offer a new route for designing molecule-based magnetic nanostructures with tunable spin-spin exchange coupling.

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