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The Effect of Electron Count and Chemical Complexity on the superconductivity of the Ta-Nb-Hf-Zr-Ti High-Entropy Alloy[1] ROBERT CAVA, FABIAN VON ROHR, Department of Chemistry Princeton University, MICHAL WINIARSKI, Faculty of Applied Physics and Mathematics, Gdansk University of Technology, JING TAO, Condensed Matter Physics Department, Brookhaven National Laboratory, TOMASZ KLIMCZUK, Faculty of Applied Physics and Mathematics, Gdansk University of Technology — High-entropy alloys (HEAs), which are stabilized by a high entropy of mixing, are made from random mixtures of many elements in roughly equal proportions. Simple crystal lattices are the result. HEAs have primarily been of interest for their mechanical properties. The recently discovered BCC Ta-Nb-Hf-Zr-Ti HEA superconductor appears to display properties of both simple crystalline intermetallics and amorphous materials - it has, for example, a well defined superconducting transition along with an exceptional robustness against disorder. In this talk I will describe our data showing that the valence-electron count dependence of the superconducting transition temperature in the high entropy alloy falls between those of much simpler analogous solid solutions and amorphous materials, and further will describe experiments about the effect of HEA complexity on the superconductivity. Finally, I propose that high-entropy alloys are good intermediate systems for studying the evolution of superconductivity between crystalline and amorphous materials.

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