Transition Temperatures of Superconductors estimated from Periodic Table Properties

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Predicting the transition temperature, Tc, of a superconductor from Periodic Table normal state properties is regarded as one of the grand challenges of superconductivity. By studying the correlations of Periodic Table properties with known superconductors, it is possible to estimate their transition temperatures. Starting from the isotope effect and correlations of superconductivity with electronegativity (\Chi), valence electron count per atom (Ne), atomic number(Z) and formula weight (Fw), we derive an empirical formula for estimating Tc that includes an unknown parameter,(Ko). With average values of \Chi, Ne and Z, we develop a material specific characterization dataset (MSCD) model of a superconductor that is quantitatively useful for characterizing and comparing superconductors. We show that for most superconductors, Ko correlates with Fw/Z, Ne, Z, number of atoms (An) in the formula, number of elements (En) and with Tc. We study some superconductor families and use the discovered correlations to predict similar and novel superconductors and also estimate their Tcs. Thus the material specific equations derived in this paper, the material specific characterization dataset (MSCD) system developed here and the discovered correlation between Tc and Fw/Z, En and An, provide the building blocks for the analysis, design and search of potential novel high temperature superconductors with specific estimated Tcs.

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