Superconductivity: Planar Weight Disparity in Relation to Critical Temperature

Nelson, Grayson (School: Sturgis Brown High School)

Superconductors and the future possibilities of seamless energy transfer and levitating trains have long been plagued by the extremely low critical temperature required, a temperature that is largely impractical at around 90 Kelvin. Due to this, there have been many efforts to increase the temperature at which a superconductor retains its unique properties. Many of these efforts have led to planar weight disparity or the tilting of the copper oxide planes in which superconductivity originates. This experiment was designed to determine if a planar weight tilt made by the stoichiometric addition of calcium carbonate in the common yttrium barium copper oxide superconductor will create a significant critical temperature increase. This experiment was completed by creating a yttrium barium copper oxide superconductor as a controlled variable and a yttrium calcium barium copper oxide superconductor as an experimental variable, then measuring the critical temperature via the Meissner effect and determining when levitation ceases. The accepted value for the critical temperature of the yttrium barium copper oxide superconductor is 93 Kelvin, and the yttrium barium copper oxide superconductor that was created exhibited a critical temperature of around 91 Kelvin. With the stoichiometric addition of calcium carbonate the critical temperature was determined to be 101 Kelvin. This study concludes that due to the addition of calcium carbonate there was a significant planar weight tilt between the copper oxide planes resulting in a greater critical temperature; furthermore, planar weight disparity is a viable method in improving the critical temperature of yttrium barium copper oxide superconductors.