

Tetragonal - FeS a high-pressure study

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We report conductivity measurements for tetragonal – FeS at atmospheric pressure and up to values of 1.64 GPa which are, as far as the authors are aware, the first low temperature transport measurements to be conducted on tetragonal FeS. The sample shows semiconducting behaviour up to the maximum pressures applied but with a gradual flattening of the resistivity curve. It is tentatively suggested that the system will undergo a semiconductor – metallic transition with a further application of pressure (as has already been shown for a number of other compounds within the iron-sulfur system). Interestingly, this contradicts band structure and more recent density functional theory (DFT) calculations which predict a metallic system. However, the experimental data agrees with the original prediction of semiconducting behaviour made by Bertaut 1965. This research also shows that, at least in its parent form, tetragonal FeS does not exhibit a superconductive state unlike its iso-structural counterpart tetragonal FeSe. The role of excess iron within the structure, and its relationship with a potential superconductive state, will also be briefly discussed.