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Investigating the Potential Verwey Transition in Pb₃Rh₇O₁₅ with Synchrotron X-rays

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The Verwey transition is a phase transition in which the development of charge order results in a rapid increase in electrical resistivity. This transition was first observed in magnetite (Fe₃O₄), which undergoes a metal-insulator transition at $T \sim 125$ K, driven by the formation of complex Fe²⁺/Fe³⁺ order. Recently, it was proposed that a similar type of transition may occur in Pb₃Rh₇O₁₅, a mixed valence (Rh³⁺/Rh⁴⁺) rhodate which displays an abrupt increase in resistivity at $T \sim 185$ K, accompanied by corresponding anomalies in specific heat, magnetic susceptibility, and diffraction data. If true, this material would mark the first example of Verwey-type physics in a heavy 4d or 5d transition metal oxide system. We have carried out a series of synchrotron x-ray scattering measurements on single crystal samples of Pb₃Rh₇O₁₅ with the goal of (a) clarifying the high and low temperature crystal structure of this compound, and (b) identifying any evidence of Rh³⁺/Rh⁴⁺ charge ordering below $T \sim 185$ K.

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