Verwey-type transition in Pb$_3$Rh$_{7-x}$Mn$_x$O$_{15}$ Solid Solution$^1$

ALVIN GATIMU, HIROSHI MIZOGUCHI, ARTHUR SLEIGHT, MAS SUBRAMANIAN, OREGON STATE UNIVERSITY MATERIALS INSTITUTE AND DEPARTMENT OF CHEMISTRY TEAM — Mixed-valence compound Pb$_3$Rh$_7$O$_{15}$ shows an isotropic room temperature resistivity ($\sim 1 \times 10^{-3}$ ohm cm) that slowly increases with decreasing temperature until 185K where the resistivity increases more rapidly as temperature is further decreased. Magnetic susceptibility and thermopower measurements on Pb$_3$Rh$_7$O$_{15}$ also show a discontinuity at about 185 K. Structural analyses of X-ray diffraction data obtained above and below 185 K indicate that a change in space group has occurred at 185 K and it is likely that this transition at 185 K is related to a charge ordering. Pb$_3$Mn$_7$O$_{15}$ also crystallizes in a similar hexagonal structure. A complete solid solution of Pb$_3$Rh$_{7-x}$Mn$_x$O$_{15}$ has been prepared and crystals with varying Mn content have been grown in a PbO flux. The phase transition at 185 K fades away as the Mn substitutes for Rh. Structural, electrical and magnetic studies are discussed.

$^1$This work is supported by a grant from the National Science Foundation (DMR 0804167).

Alvin Gatimu

Date submitted: 05 Nov 2009

Electronic form version 1.4