Ruthenium (IV), Iridium (IV) and Manganese (IV) incorporation into three-layer Aurivillius phases

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Here we report the first incorporation of ruthenium (IV) and Iridium (IV) into Aurivillius [1],[2] phases, having prepared single-phase three-layer Aurivillius $Bi_{2-x}Sr_{2+x}M_{2+x}(Ru/Ir)_{1-x}O_{12}$, *M* = Nb or Ta, x ~ 0.5. We have also prepared manganese (IV) analogues $Bi_{2-x}Sr_{2+x}M_{2+x}Mn_{1-x}O_{12}$, *M* = Nb or Ta, x ~ 0.6. The highly analogous structures of the Mn- and Ir-/Ru-doped phases appear to resolve a debate in literature concerning the Mn oxidation state and phase purity of previously reported Mn-doped Aurivillius phases.[3],[4] The samples indicate only a limited amount of Ru (IV), Ir (IV) and Mn (IV) can be incorporated into three-layer Aurivillius phases. Rietveld refinements against neutron and synchrotron X-ray powder diffraction data suggest that the majority of the magnetic Ru, Ir and Mn cations occupy the central layer of the three perovskite-type layers. This raises the interesting possibility of multiferroic (magnetoelectric) behaviour in these doped Aurivillius phases. Physical property measurements of Ru (IV) and Ir (IV) show weak anti-ferromagnetic interactions at low temperatures, whereas the Mn (IV) samples show weak ferromagnetic properties.

References

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