Supporting Information

Synthesis, Structure, and Magnetic Properties of Novel B-site Ordered Double Perovskites, $SrLaMReO_6$ (M = Mg, Mn, Co and Ni)

Corey M. Thompson,^{a,b} Lisheng Chi,^c John R. Hayes,^d Alannah Hallas,^e Murray Wilson,^e Tim J. S. Munsie,^e Ian P. Swainson,^c Andrew P. Grosvenor,^d Graeme Luke,^{b,e} John E. Greedan^{a,b}

^aDepartment of Chemistry and Chemical Biology, McMaster University, Hamilton, ON, L8S 4M1, Canada ^bBrockhouse Institute of Materials Research, McMaster University, Hamilton, ON, L8S 4M1, Canada ^cCanadian Beam Neutron Centre, National Research Council, Chalk River Laboratories, Chalk River, ON, K0J 1J0, Canada ^dDepartment of Chemistry, University of Saskatchewan, Saskatoon, SK, S7N 5C9, Canada

^eDepartment of Physics and Astronomy, McMaster University, Hamilton, ON, L8S 4M1, Canada

Email: thompco@mcmaster.ca

| Figure S1. Refined X-ray powder diffraction patterns at 298 K of SrLaMReO ₆ phases | S2 |
|--|----|
| Figure S2. Refined powder neutron diffraction patterns of SrLaMnReO ₆ phase | S3 |
| Figure S3. Refined powder neutron diffraction patterns of $SrLaMReO_6$ phases (M = Co and Ni) | S4 |
| Figure S4. Refined powder neutron diffraction pattern of La ₅ Re ₃ MnO ₁₆ | S4 |



Figure S1. Refined synchrotron X-ray powder diffraction patterns at room temperature of SrLaMReO₆ phases. Note: shown are the first two superstructure peaks indicating M/Re ordering in the $P2_1$ /n system.



Figure S2. Refinement of the neutron diffraction pattern at 8 K for SrLaMnReO₆ magnetic structure with $k = 0 \ 0$ a,d) the refinement results with both Mn and Re moments refined; b,e) the refinement results with no Re moment and just the Mn moment refined; c,f) the refinement results with the Re moments fixed and antiparallel to the Mn moments.



Figure S3. Refinement of the neutron diffraction patterns at 8 and 9 K for $SrLaCoReO_6$ (left) and $SrLaNiReO_6$ (right), respectively.



Figure S4. Refinement of the neutron diffraction pattern at 10 K for La₅Re₃MnO₁₆ having a magnetic structure with k = 0.0 1/2.