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Structural, Magnetic and Transport Properties of a New Class of Ferromagnetic Semiconductors/Metals: (Ba, Sr)$M_{2\pm x}Ru_{4-x}O_{11}$ (M = Fe, Co)[1] LARYSA SHLYK, LANCE DE LONG, SERGIY KRYUKOV, Dept. of Physics and Astronomy, University of Kentucky, BARBARA SCHÜPP-NIEWA, RAINER NIEWA, Department Chemie, Technische Universität München — Single crystals (mm size) of (Ba, Sr)$Fe_{2+x}Ru_{4-x}O_{11}$ and (Ba, Sr)$Co_{2+x}Ru_{4-x}O_{11}$ were grown for the first time. X-ray refinements confirmed a hexagonal space group ($P6_3/mmc$, No. 194) with two crystallographic sites having mixed Ru and Fe/Co occupation, and one site occupied exclusively by the 3d species. Structural parameters and charge balance suggest oxidation states Co^{2+} and mixed Ru^{3+}/Ru^{5+} in the Co compound, and mixed Fe^{2+}/Fe^{3+} and Ru^{3+}/Ru^{5+} in the Fe compound. The physical properties of these single crystals are sensitive to site disorder among the transition metal ions. Magnetic and transport measurements show the Co-bearing barium ferrite is a ferromagnetic metal below 105 K. In contrast, Fe-bearing barium and strontium compounds exhibit long-range ferromagnetic order at temperatures above 400 K, and narrow-gap semiconducting properties that include a large anomalous Hall conductance, low resistivity, and high carrier concentration. These characteristics make the Fe-bearing materials promising new candidates for spintronic applications.

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