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Transition-metal-based perovskite oxides for enhanced thermopower STANISLAW KOLESNIK, BOGDAN DABROWSKI, Department of Physics, Northern Illinois University, DeKalb, IL and Materials Science Division, Argonne National Laboratory, Argonne, IL, KRZYSZTOF WOJCIECHOWSKI, Faculty of Materials Science and Ceramics, AGH-UST, Cracow, Poland, KONRAD SWIERCZEK, Faculty of Energy and Fuels, AGH-UST, Cracow, Poland — Due to the enhancement of thermopower by spin and orbital degrees of freedom, transition-metal-based perovskite oxides are good candidates for stable and nontoxic materials with a large thermoelectric figure of merit ZT. We have investigated the most promising Mn-, Co- and Ti-based perovskite oxides. Electron doping of $SrMnO_3$ materials on either Mn or Sr sites induces a rapid decrease in both electrical resistivity and thermopower with the doping level due to the introduction of itinerant charge carriers. The thermopower of electron-doped $SrTiO_3$ materials satisfy the basic Heikes description, however, no additional enhancement is observed. The hole-doped RCoO$_3$ perovskites exhibit limited solubility of alkaline earth's for small rare earth ion sizes. The dependence of thermopower on charge doping and temperature appears to follow the extended Heikes formulation only at low doping and below 300 K, which indicates that Co^{3+} and Co^{4+} exist in several spin states beyond that range. Among all investigated compounds the largest ZT$\sim$0.3 values were observed for 3-8% Nb-substituted $SrTiO_3$ materials at about 700 K. Supported by the U.S. DOE-BES DE-AC02-06CH11357.

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