Crystal Chemistry, Phase Diagrams, and Thermoelectric Properties of the Ca-M-Co-O (M=Sr, Zn, La, Sm, Eu, Gd, and Dy) Systems

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For waste heat energy conversion applications, oxide materials which have high temperature stability are potential candidate materials. In the Ca-M-Co-O (M=Sr, Zn, La, Eu, Sm, Gd, and Dy) systems, in addition to the well-known $Ca_3Co_4O_9$ phase (with misfit layered structure) that has excellent thermoelectric properties, and the M-doped phases $(Ca,M)_3Co_4O_9$ or $Ca_3(Co,M)_4O_9$ phases, other low-dimensional phases include the homologous series, $A_{n+2}Co_nCo'O_{3n+3}$ (where A= (Ca, Sr) and (Sr,Ca)), $Ca_{n+2}(Co,Zn)_n(Co',Zn)O_{3n+3}$, and $(M_{1+x}Ca_{1-x})CoO_{4-z}$. While the members of the $A_{n+2}Co_nCo'O_{3n+3}$ series have reasonably high Seebeck coefficients and relatively low thermal conductivity, the electrical conductivity needs to be increased in order to achieve higher figure of merit (*ZT*) values. This talk discusses our phase equilibria/structural/property studies of selected cobaltates in the Ca-M-Co-O systems.