HIGH ENTROPY RARE EARTH $A_2B_2O_7$ TYPE ZIRCONATES

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High entropy ceramics present an intriguing class of materials for extreme environment thermal protection applications due to a wide range of potential compositions allowing for thermal property tuning and high temperature stability. In this work 5 component rare earth zirconates, general formula $A_2Zr_2O_7$ where A = La^{3+}, Nd^{3+}, Sm^{3+}, Eu^{3+}, Dy^{3+}, Y^{3+}, Er^{3+}, Ho^{3+}, or Yb^{3+}, were investigated. A_2BO_7 type zirconates exist as either pyrochlore (Fd-3m) or weberite type defect fluorite (Fm-3m) structures determined by the ratio of the A to B site ionic radii. These materials demonstrate high thermal expansion and low thermal conductivity behavior with single rare earth element A-site occupancy, additionally there have been reports that further reduction of the thermal conductivity is possible through substitution of additional rare earth cations. We furthered this concept by placing 5 rare earth cations in equimolar concentration on the same crystallographic site to determine the effect of cation size mismatch on thermal conduction, thermal expansion, and specific heat properties. Additionally, the relationship of these thermo-physical properties to the crystallographic properties will be discussed relative to cation-oxygen bond lengths and bond energies explored by in situ high temperature x-ray diffraction and high temperature Raman spectroscopy.

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