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Synthesis and Structure of Novel Oxide Compounds Containing RE = Y, Yb, Gd, Sm, and La and M = Zr, Ti, and Sn

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With the aim of creating novel ceramics with high radiation tolerance and ionic mobility, multiple samples with A-B-O stoichiometries ranging from 215 to 227 were synthesized and characterized by a combination of SEM, XRD, and TEM methods. Single-phase defect-fluorite-type compounds with A = Sm or Yb and B = Ti, Zr, and/or Sn are reported; whereas, pyrochlore compounds were also found as a second major RE-phase in numerous samples. We describe some interesting TEM data showing selected area diffraction patterns with complex modulations. The details of the modulation wave vectors observed in these samples are reported in some detail. The use of ionic radii to predict the structure of these ceramics appears to be substantially limited by Sn-O bonding characteristics and somewhat limited for zirconate compounds. Some single phase ceramics were irradiated with a low dose of helium and no significant radiation damage was observed by comparative GIXRD and nano-indentation.

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