Supporting information

Planar Symmetry Incompatibility in Ru-Sn-Zn Pseudo-Decagonal Approximants Composed of Novel Pentagonal Antiprisms

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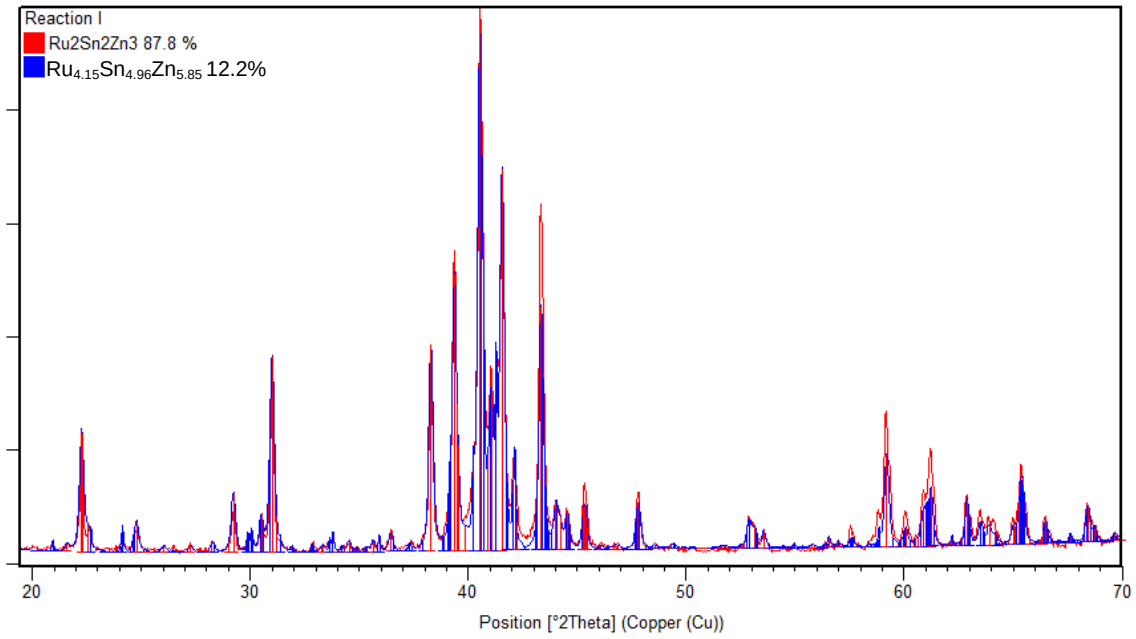
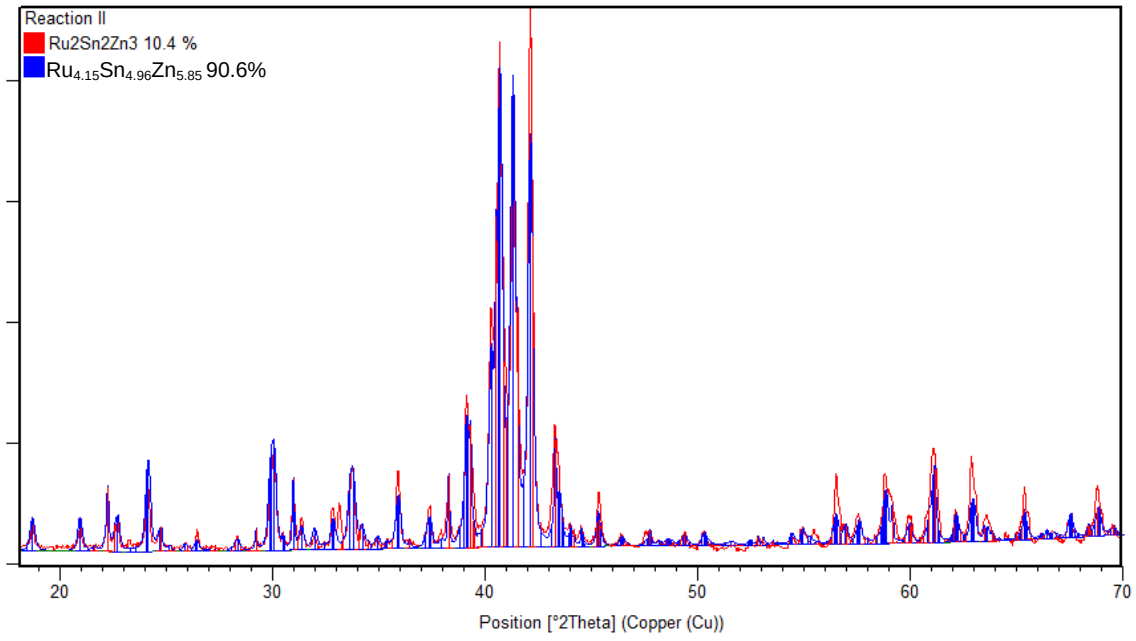
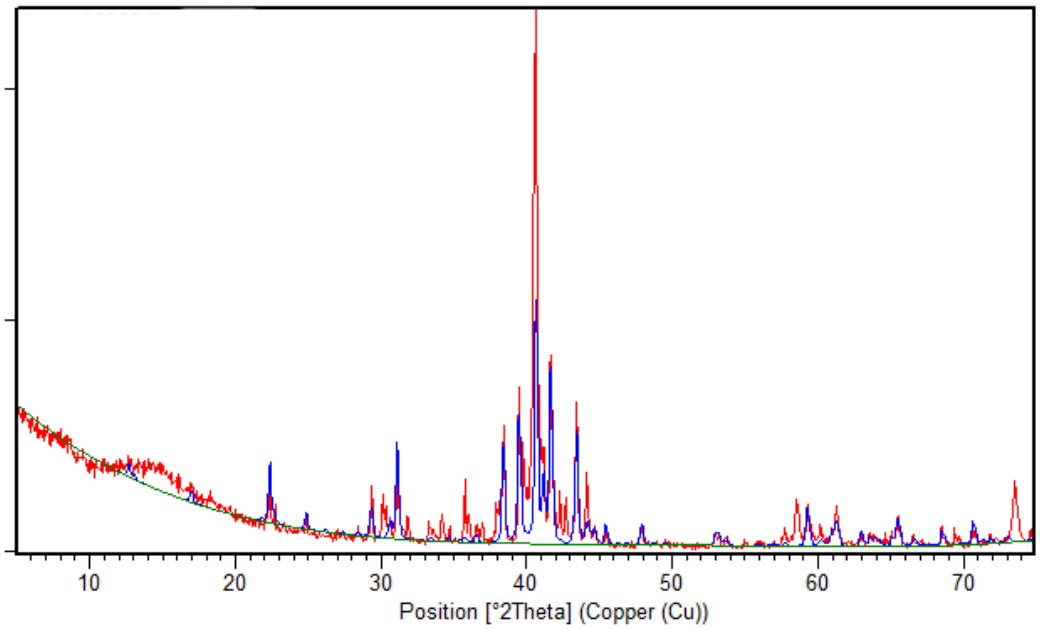


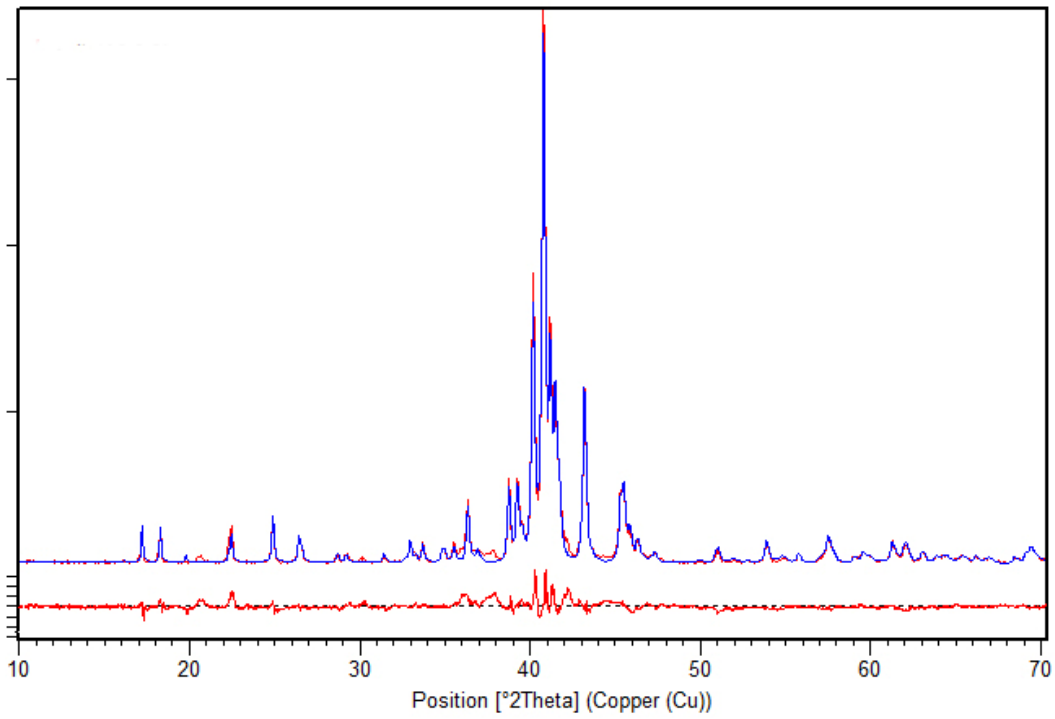
Reaction **I**: $Ru_4Sn_4Zn_6$



Reaction **II**: $Ru_4Sn_5Sn_6$



Reaction **III:** $Ru_4Sn_4Zn_4$ (~50% $Ru_2Sn_2Zn_3$ + ~50% unidentified phases)



Reaction **IV**: $Ru_4Sn_{2.9}Zn_{11}$ (~98% $Ru_4Sn_{2.9}Zn_{11.6}$)

Figure S1. Rough phase analysis of the samples from the reactions with different nominal compositions (below each pattern). Shown are the experimental powder diffraction patterns (red lines) with the simulated profiles (blue lines), Bragg positions, and difference plots.

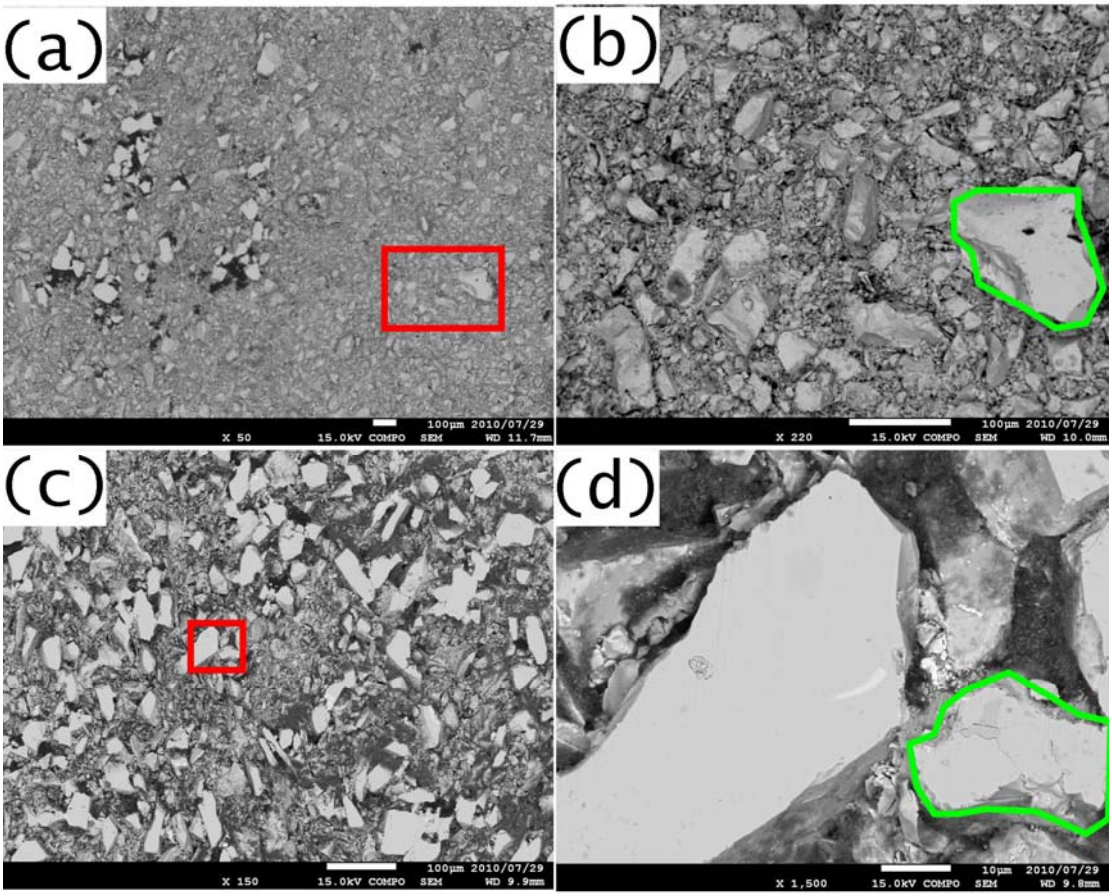


Figure S2. SEM backscattered electron images of the samples from the reactions with the nominal compositions of (a,b) $Ru_2Sn_2Zn_3$ (reaction **I**) and (c,d) $Ru_4Sn_5Zn_6$ (reaction **II**). The red rectangles mean the areas were selected to be enlarged in (b) or (d). The green polygons mean the representative of one phase presented in the other one as impurities. The summary is given in Table 1 in the maintext.

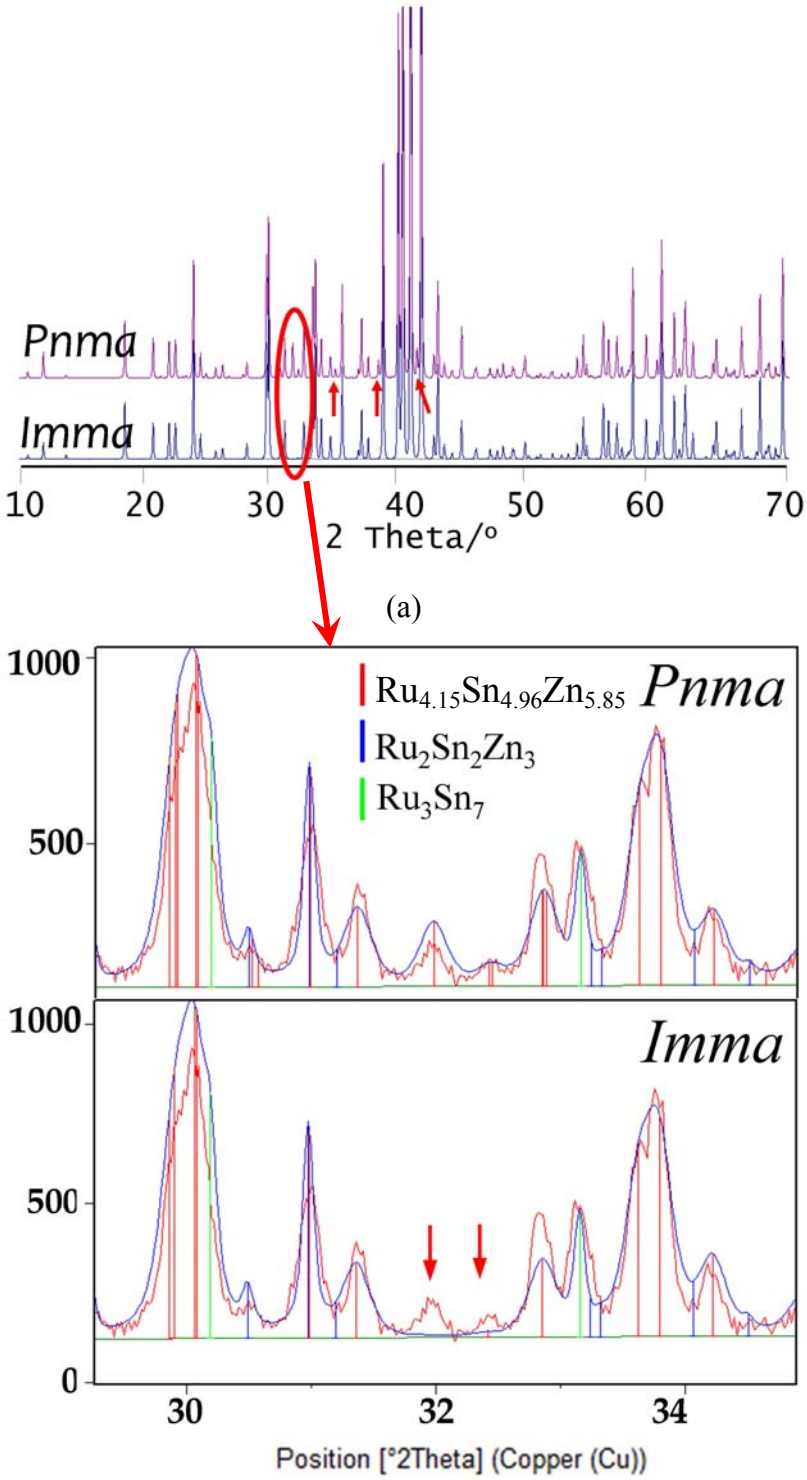
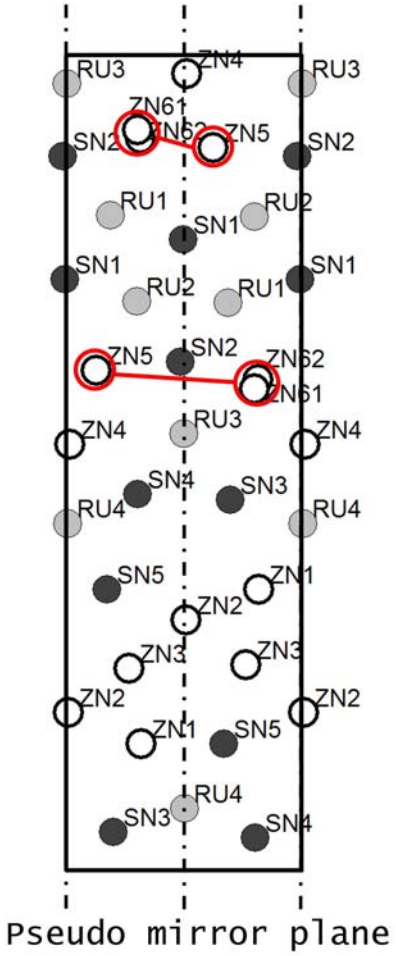
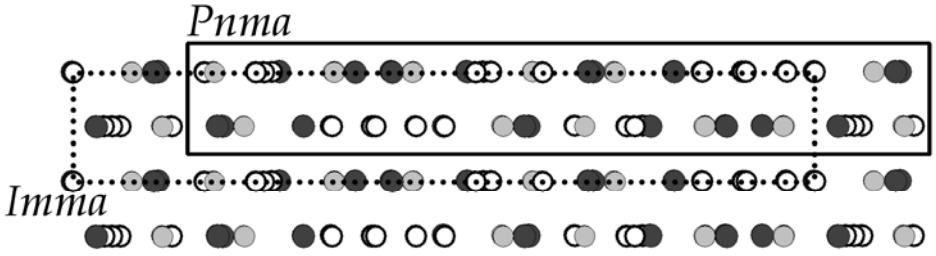


Figure S3. (a) The simulated patterns using two structural models with space group *Imma* and *Pnma*, respectively. The most significant discrepancy between them is highlighted by a red ellipsoid and arrows. (b) The Rietveld refinements with two different structure models. Red and blue lines are experimental and simulated patterns, respectively, and some impurities are included. Only the 2θ range from 29° to 35° is shown for the most remarkable difference.



(a)



(b)

Figure S4. (a) The pseudo mirror planes at x = 0.0 and 0.5 can be imaged according to the atomic type and coordinates in *ac* plane at height of y = 0.75 in phase. (b) The unit cell with real (solid line) and hypothetical (dash line) space group.