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The AuIn 1:1 phase and its siblings

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Recently, the Gold Indium system has regained interest due to its importance for applications in soldering and nanowire growth. For these applications knowledge of the occurring components in the phase diagram is important. Earlier studies of this alloy were able to uncover most currently known compounds along with their crystal structures. Only the structure of the seemingly most straight-forward one, AuIn 1:1, has not been elucidated. Its lattice parameters are known from earlier experiments [1], but growth of single crystals has proved difficult.
With the help of a Differential thermal analysis study, which revealed an additional exothermic peak, it was however possible to grow X-ray suitable crystals. Synchrotron Xray diffraction was performed on a chosen specimen, unveiling a cascade of structural rearrangements with temperature.
At high temperatures (T=400°C) the structure of AuIn is found to be 3D with the orthorhombic space group Cmcm and showing a certain degree of disorder evidenced by diffuse scattering. At T=300°C the structure has undergone a space group transformation towards the incommensurate $C\bar{1}(\alpha\beta\gamma)0$, showing first order satellites but surprisingly keeping the shape of the network the same as at 400°C. At room temperature AuIn is found to have the same space group and structure as at 300°C but now showing satellites up to third order [2].
Currently research is undertaken to confirm that this is not a specialty of AuIn, but also appears in other structures. Therefore alloys which show the TlI- or a similar structure, were synthesized and measured in the DTA. This currently indicates that PdBi and PdPb behave similarly as AuIn (see Fig1, where an overlay of the DTA measurements of AuIn, PdBi and PdPb is plotted. Blueish colors depict AuIn, greenish PdBi and pinkish PdPb. Full lines show heating cycles and broken lines show cooling cycles. The H and C in the legend stand for heating and cooling, respectively.). For PdBi and PdPb crystals were grown and measured on an in-house source, both showing structures with different degrees of commensurate modulation.
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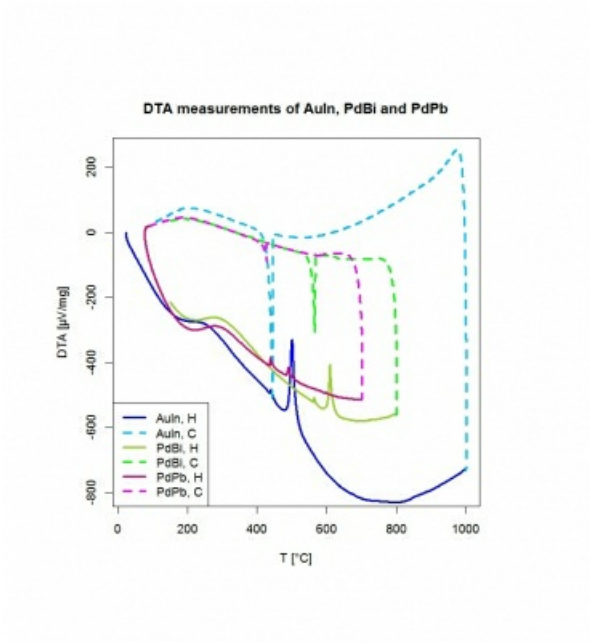

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