Melting curve and structure of hot dense Gold probed by X-ray diffraction

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Gold is certainly unique among the elements for its exceptional chemical inertness, durability and structural stability to extreme conditions of pressure and temperature. This is why it has long-played the role of high pressure standard and is used as a pressure calibrant in a large number of high pressure experiments. The equation of state (EOS) of solid gold has been accurately established over a wide range of pressure and temperature conditions from experimental data and thermodynamic modelling, which in turn ensures reliable pressure measurements in high pressure experiments, especially in the DAC [1]. Surprisingly though, there is much less knowledge about the melting and fluid properties of gold. The melting line has been investigated by several authors in a large-volume apparatus up to 6-7 GPa[2,3], using the change of the sample electrical resistance to detect melting. The same criteria has also been used in recent experiments using the resistively heated DAC (RHDAC) up to 21 GPa [4]. To our knowledge there is only one attempt to determine the melting curve of gold in a Laser heating DAC (LHDAC) experiment, to 35 GPa [5]. This is probably due to the difficulty of heating gold with lasers in the DAC and reliably measuring its temperature because of its complex emissivity. We have developed an original sample geometry that allows overcoming these limits. The measurement of the melting curve up to 1 Mbar and comparisons with the theoretical model will be presented.

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