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Melting curve of metals evidenced by X-ray diffraction

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There has been a consistent pattern of disagreement between the determinations of high pressure melting by two experimental techniques, the static laser-heated diamond anvil cell (LHDAC) and the dynamic shock wave compression. For several elements, "high" and "low" melting points have been measured by shock compression and LHDAC, respectively. The difference could exceed one thousand of K. We have re-visited the melting curve of a few metals in a LHDAC: lead, tantalum, beryllium and iron. We have used an alternative diagnostic of melting, based on X-ray diffraction instead of optical detection. The melting curves obtained with this diagnostic are in correct agreement with shock wave data. Movements of the sample surface, which were previously interpreted as a melting signature, could be due to a fast recrystallization of the solid sample. This fast recrystallization is evidenced by X-ray diffraction up to several hundreds of degrees below melting for some metals.