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Steels and intermetallics under extreme conditions

Materials are being designed and engineered for ever superior mechanical and operational properties, such as steels for lighter cars and energy-absorbing behavior in an accident, and titanium aluminides for lighter airplane turbine blades. The manufacturing of such materials may involve processes at extreme conditions, under high pressure or high temperature. Examples are high-pressure torsion and near net-shape forging. Therefore, it becomes eminently important to know and understand the phase diagrams of such materials at extreme conditions. Structural changes may open processing windows, while elevated mechanical properties are conserved under less extreme conditions. Here, we present first phase diagram studies on high-manganese steels and on titanium aluminides by in-situ synchrotron X-ray diffraction in a large-volume cell.

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