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Modelling of Multiple Phase Transitions Under Shock in Ice DAVID HEBERT, ISABELLE BERTRON, CEA/CESTA, OLIVIER HEUZE, CEA/DAM/DIF — For several decades, experiments have shown the behavior under shock of materials featuring phase transitions. They exhibit shock splitting and rarefaction shocks. If the main phenomena are now understood, most studies are limited to the qualitative behavior, and a quantitative analysis of experimental results remains to be done in most cases involving complex materials, waves or geometries. In former studies, we have proposed a thermodynamic description of multiphase material in equilibrium (up to ten phases in bismuth), shown its ability to be used in hydrocodes, and demonstrated the good qualitative results obtained on tin at different impact velocities. We have also raised the numerical problems involved by phase transitions in hydrocodes. In the present study, we have undertaken calculations on ice to reproduce quantitatively an impact experiment on ice with double phase transition. We have built a six phases equation of state for ice which reproduces experimental equilibrium phase diagram and Hugoniot curves. Our first hydro calculations provide the pressure levels, but exhibit an elastic precursor and kinetics of phase transition effects. We explain how we take these phenomena into account to obtain a good agreement between numerical and experimental results.

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