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Complete Forms of the Mie-Gruneisen Equation of State OLIVIER HEUZE, CEA/DIF — The Mie-Grüneisen equation of state is often used in hydrocode simulations to model condensed materials at high pressure. It is defined in an incomplete form P(V,E) which does not allow access to temperature and entropy. We have extended it to the complete form S(V,E) which is the combination of three independent models: an isentropic or isotherm potential, Debye Temperature from which we derive the Grüneisen coefficient, and a new function which gives the specific heat by derivation. Then, we access to all the thermodynamic properties. Former versions were limited by a constant heat capacity. The new function introduced here has overcome this limitation and allows now to extent to Einstein, Debye or other more accurate models for heat capacity. Moreover, its Legendre transform provides the F(V,T) form. The combinations with published models for the potential and Debye temperature are unlimited. This complete form is especially useful to build EOS with phase transitions. We have applied it to most elements of Mendeleiev table, depending on the availability of their physical data, and we reproduce their (P,T) phase diagram, up to ten phases for Bi.

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