A New Semi-Analytical On-Hugoniot EOS of Materials with Known Shock Velocity Parameters

SEIJI SUGITA, KOSUKE KUROSAWA, Univ. of Tokyo, TOSHIHIKO KADONO — Accurate equation of state (EOS) is essential for understanding a variety of geologic processes associated with shock compression of materials. A number of highly sophisticated EOS’s have been proposed (e.g., MANEOS and SESAME), covering a wide range of P-T conditions. However, they are complex and require many model parameters. Also, there are many occasions when only terminal thermodynamic variables after adiabatic de-compression are needed. For example, when the terminal molecular composition of an impact-induced vapor is necessary, only the initial entropy gain and chemical reaction processes under low-P-T conditions need to be calculated. Then, only an on-Hugoniot EOS and a low-P-T EOS are necessary. To meet such demand, we derive a new semi-analytical on-Hugoniot EOS, which requires only the Hugoniot shock velocity parameters and specific heat. Comparison with experimental data indicates that this EOS can reproduce on-Hugoniot entropy and temperature of ice and quartz very well, despite of its small number of model parameters. Our new EOS will be useful for studying chemical reactions in shock-induced vapor plumes.

Seiji Sugita
Univ. of Tokyo

Date submitted: 18 Feb 2011