Table 3.3
Selected hydrodynamic data

Reference	Remarks
McQueen et al. [67M2]	12 rocks, 10 to 100 GPa
Isbell et al. [68I1]	Gun data to 500 GPa for 11 materials
Group GMX-6 [69G2]	Published data reanalyzed using [70M1]
Dick [70D1]	C_6H_6, CS_2, CCl_4, N_2, 19 to 63 GPa
Dick et al. [70D2]	Solid argon, 1.8–6.45 GPa
McQueen et al. [70M1]	60 technical materials, 5 standards
Zharkov and Kalinin [71Z2]	Elements, alkali halides and rocks
Carter et al. [71C2]	Al 2024, Cu, Ag, Na, Mo, Pd, Mg, MgO
Fritz et al. [71F2]	NaCl crystals, 3 to 26 GPa
Ahrens et al. [71A1]	Forsterite (Mg_2SiO_4), 11 to 37 GPa
Ahrens and Gaffney [71A2]	Enstatite ($(Mg_{0.86}Fe_{0.14})SiO_3$, 6–48 GPa
Lysne [72L3]	Organic liquids at low pressure
Kalashnikov et al. [73K1]	Six calcite minerals, 10 to 100 GPa
Gust et al. [73G6]	TiB_2, SiC, Be_4B to $\sim$100 GPa
Lysne and Hardesty [73L4]	Nitromethane
Carter [73C3]	LiF, NaF, LiCl, LiBr, 7 to 100 GPa
Dobratz [74D3]	25 unreacted explosives
van Thiel et al. [74V1]	Liquid deuterium, 20 and 90 GPa
Simakov et al. [74S4]	12 minerals, 10 to 300 GPa
Syono et al. [74S7]	Fe_2O_3 and Fe_3O_4 to 50 GPa
Syono et al. [74S8]	TiO
Mitchell et al. [74M1]	Brass at 50 and 100 GPa, various temp.
Morgan [74M2]	Platinum, 290 to 680 GPa
Barker [75B1]	α-phase iron
Morgan [75M1]	Stainless steel alloy 347, 183–384 GPa
Bakanova et al. [76B1]	Water, 3–50 GPa
Goto et al. [76G2]	GaAs to 40 GPa
Ragan et al. [77R1]	Molybdenum at 2000 GPa
Al'tshuler et al. [77A1]	Latest Soviet work at extreme pressure
McMahan et al. [77M6]	Metallic iodine, 74–180 GPa
Al'tshuler and Pavlovskii [71A4]	Clay and clay shale, 3 to 77 GPa
Kalashnikov et al. [72K1]	Polytetrafluoroethylene 1.4 to 175 GPa
Podurets et al. [72P1]	Water to 1400 GPa. See also [76B1]
Grady et al. [76G3]	Dolomite, 18 to 42 GPa
Mitchell and Nellis [79M1]	Water, 30 to 220 GPa
Ahrens [79A1]	Pyrrhotite ($Fe_{0.9}S$), 3 to 158 GPa

suggest that some downward curvature can be expected to become apparent when the range of u is great enough. In the latest work of Al'tshuler et al. [77A1], in which data at extreme pressures are considered, the slope of the (U, u) Hugoniot is found to decrease significantly with increasing compression. In spite of these considerations, the linearity of the (U, u) Hugoniot curve is so common an outcome of a program of shock-compression experiments that instances in which pronounced deviations are observed deserve examination for evidence of elastic-plastic response, collapse of porosity unintentionally present in the material, a phase transformation, systematic error in measurement, or other identifiable cause.

Example: the high-pressure Hugoniot curve of copper. It is not possible to discuss all of the available (U, u) Hugoniot data in a review of this length, but it seems worthwhile to give a flavor of the work that has been done by considering, as an example, the data that describe the Hugoniot

Table 3.4
Measurements of the high-pressure Hugoniot curve of copper

reference	Pressures (GPa)	No. of data	Loading method[a)]	Detector method[b)]	Interpretation method[c)]	Hugoniot U, m/s	Remarks
an [55W1]	18–46	12	CD	F	FSV		
2]	22–51	5	CD	F	FSV and R	$3944+1.514u$	aluminum st
8A2]	45–380	3	U	P	R	$3900+1.46u$	iron standar
0A1]	108–418	3	FP (U)	P	D	$4200 + 1.41u$	
ırsh [60M1]	88 and 144	3 and 3	FP	F	R	$3958+1.497u$	brass standa
2A1]	907	1	U	P	D		iron striker a
on (1964), [77V1]	72–127	9	U	F	D	$4640+0.98u$	
ignon (1964), [77V1]	74–164	45	U	P, F	U	$4120+1.81u$	
é [68A4]	20–441	16	CD, FP, I	F	FSV	$3940+1.55u-1.5\times10^{-5}(u)^2$	ten highest v convergent v
	99–450	12	G	P	D	$3964+1.463u$	
2]	1569	1	N	P	R		lead standar polated). p corrected t in [77A1]
0M1]	8–217	127	CD, FP	F	FSV, R	$3940+1.489u$	Al, Fe and U standards
3]	3800	1	N	P	R		lead standar polated). p corrected t in [77A1]

etonation, FP = explosively driven impactor, G = gun-driven impactor, I = impactor driven by convergent detonation, N = nuclear expl
ed, U = unspecified. We believe pressures in the range ~200–1000 GPa to have been achieved by method I (except [68I1]).
act pins, F = optical flasher.
ct or deceleration method, R = impedance mismatch or reflection method, FSV = velocity of the stress-free surface measured.