

Property	High-speed steels	Cast-cobalt alloys	Carbides		Ceramics	Cubic boron nitride	Single-crystal diamond
			WC	TC			
Hardness	83–86 HRA	82-84 HRA 46-62 HRC	90–95 HRA 1800-2400 HK	91–93 HRA 1800-3200 HK	91–95 HRA 2000-3000 HK	4000-5000 HK	7000-8000 HK
Compressive strength, MPa psi * 10 ³	4100-4500 600-650	1500-2300 220-335	4100-5850 600-850	3100-3850 450-560	2750-4500 400-650	6900 1000	6900 1000
Transverse rupture strength, MPa psi * 10 ³	2400-4800 350-700	1380-2050 200-300	1050-2600 150-375	1380-1900 200-275	345-950 50-135	700 105	1350 200
Impact strength J in lb	1.35–8 12–70	0.34–1.25 3–11	0.34–1.35 3–12	0.79–1.24 7–11	60.1 61	60.5 65	60.2 62
Modulus of elasticity GPa Psi * 10 ⁶	200 30	– –	520–690 75-100	310–450 45–65	310–410 45–60	850 125	820–1050 120–150
Density kg/m ³ lb/in ³	8600 0.31 7–15	8000–8700 0.29–0.31 10–20	10,000–15,000 0.36–0.54 70–90	5500–5800 0.2–0.22 –	4000–45000 0.14–0.16 100	3500 0.13 95	3500 0.13 95
Volume of hard phase, % Melting or decomposition temperature, °C °F	1300 2370	– –	1400 2550	1400 2550	2000 3609	1300 2400	700 1300
Thermal conductivity, W/m K	30–50	–	42–125	17	29	13	500–2000
Coefficient of thermal expansion, * 10⁻⁶/°C	12	–	4–6.5	7.5–9	6–8.5	4.8	1.5–4.8

- Table 2.2 show the operating characteristics of cutting tool materials in machining

Table 2.2: General Characteristics of Cutting Tool Materials

General Characteristics of Cutting-Tool Materials (These Tool Materials have a Wide Range of Compositions and Properties. Overlapping Characteristics Exist in Many Categories of Tool Materials).							
	High-speed steels	Cast-cobalt alloys	Uncoated carbides	Coated carbides	Ceramics	Polycrystalline cubic boron nitride	Diamond
Hot hardness	→						
Toughness	←						
Impact strength	←						
Wear resistance	→						
Chipping resistance	←						
Cutting speed	→						
Thermal-shock resistance	←						
Tool materials cost	→						
Depth of cut	Light to heavy	Light to heavy	Light to heavy	Light to heavy	Light to heavy	Light to heavy	Very Light for single-crystal diamond
Processing method	Wrought cast. HIP*sintering	Cast and HIP sintering	Cold pressing and sintering	CVD or PVD	Cold pressing and sintering or HIP sintering.	High-pressure, high-temperature sintering	High-pressure, high-temperature sintering

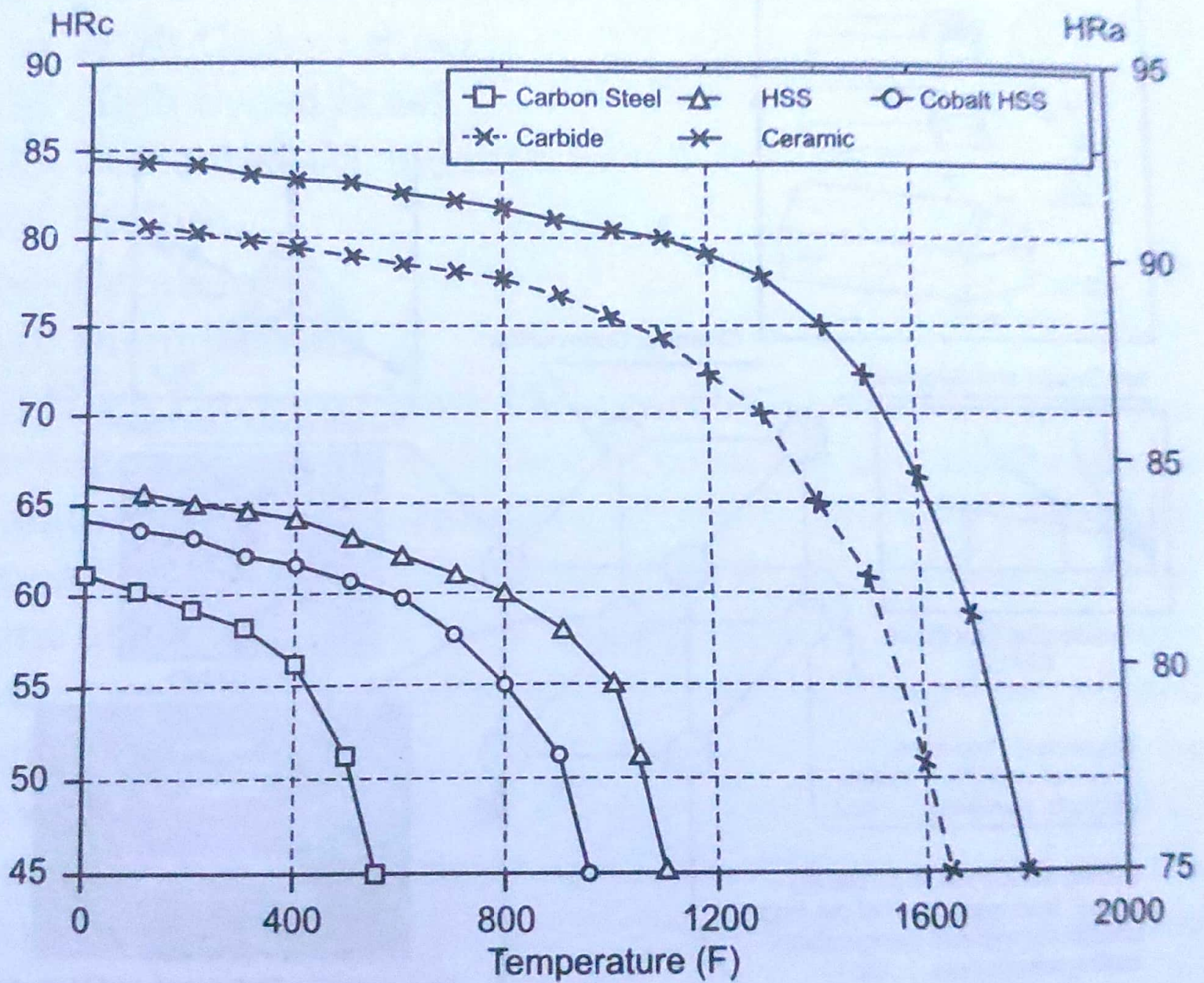


Fig. 2.3: Relationship Between the Temperature and Hardness for Various Cutting Tool Materials

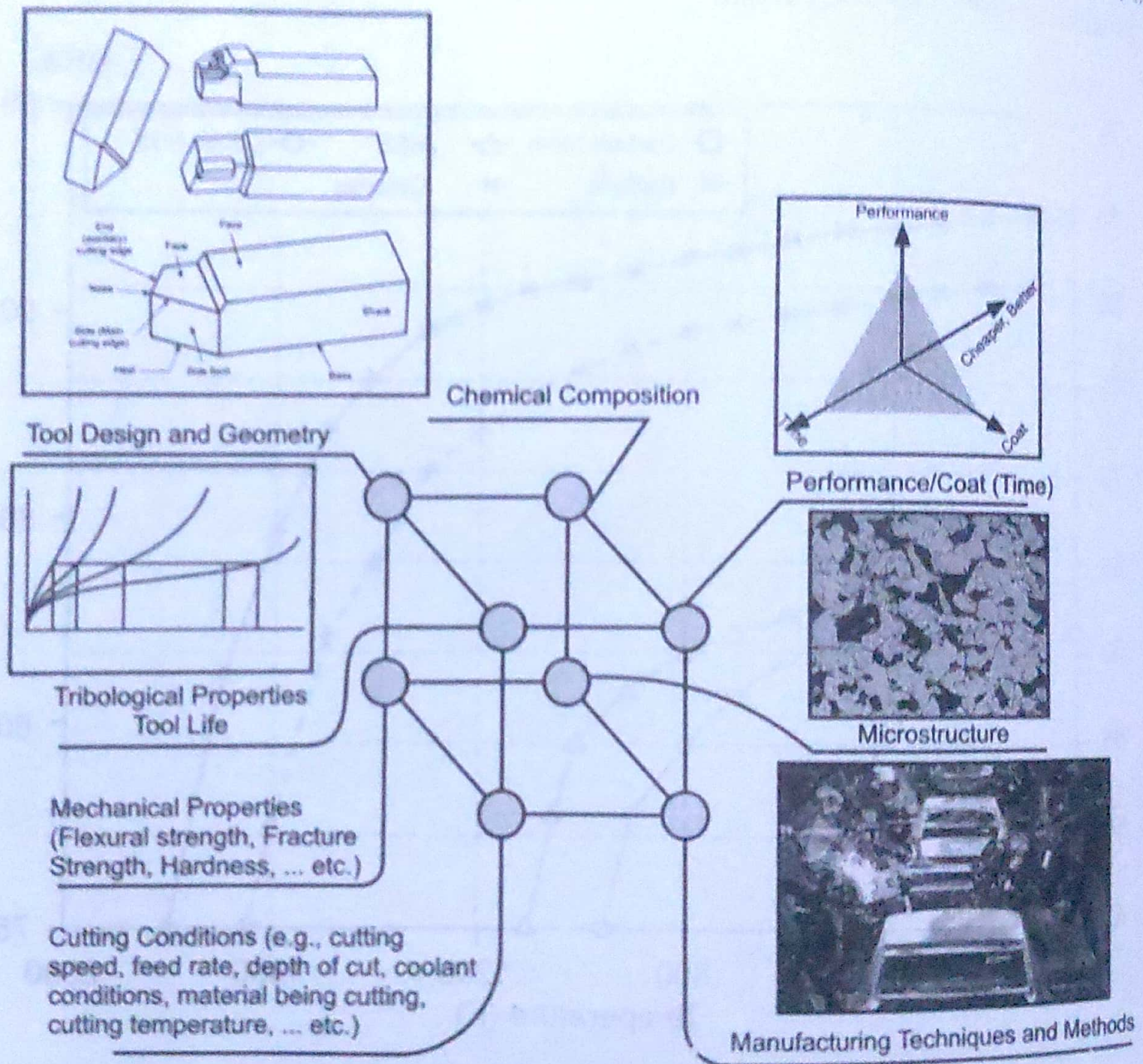


Fig. 2.4: Requirement for Ceramic Cutting Tools