

Figure 3-6. Chemical vapor deposition.

2.3 Boron Fibers

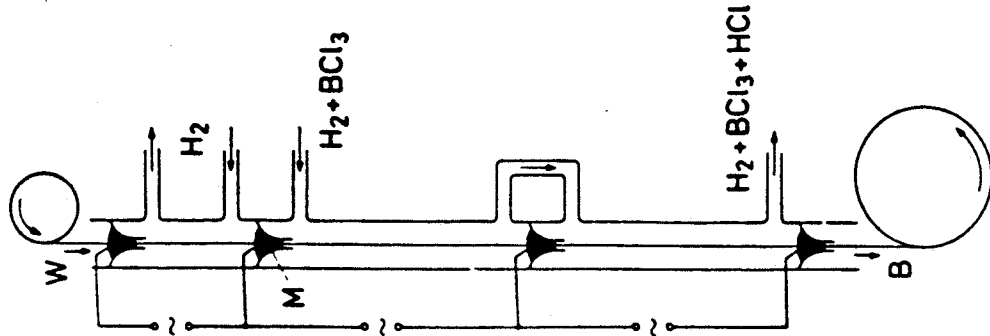


Fig. 2.7. Schematic of boron (B) fiber production by halide decomposition on a tungsten (W) substrate. (From Ref. 15, used with permission.)

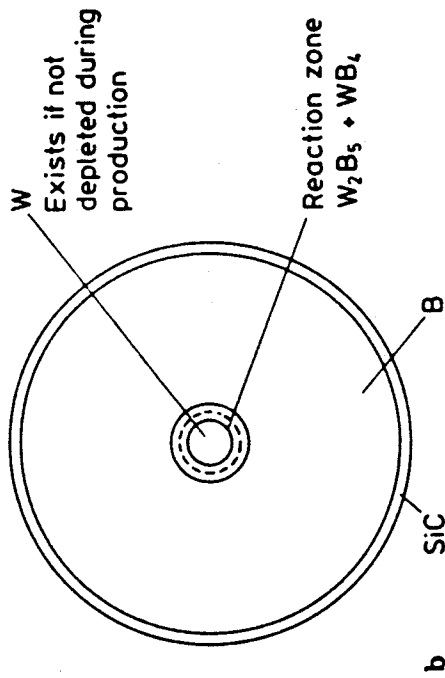


Fig. 2.10. a Cross section of a 100- μm diameter boron fiber. b Schematic of the cross section of a boron fiber with SiC barrier layer



Fig. 2.11. Characteristic corn-cob structure of boron fiber. (From Ref. 15, used with permission.)

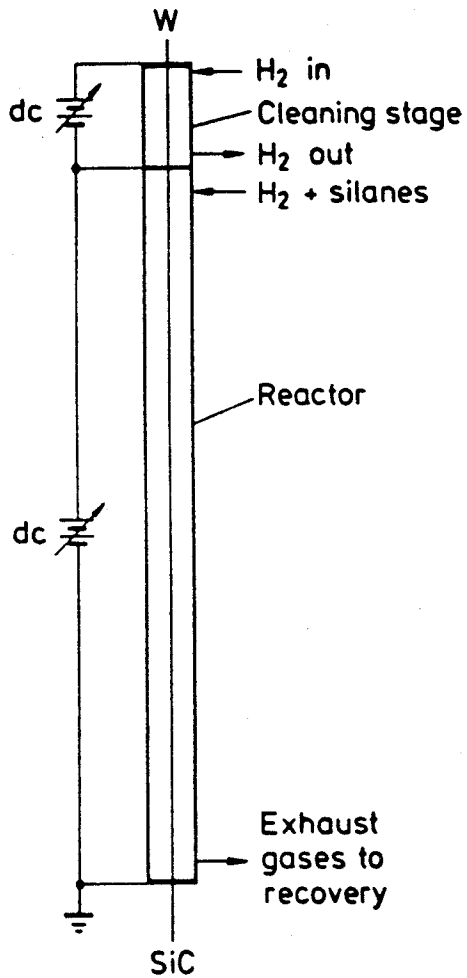
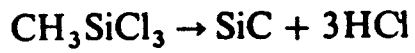


Fig. 2.42. CVD process for SiC monofilament fabrication. (Reproduced by permission of the University of South Carolina Press from *Production of Silicon Carbide from Rice Hulls* by J.V. Milewski, J.L. Sandstrom, and W.S. Brown in *Silicon Carbide-1973* edited by R.C. Marshall, J.W. Faust, Jr., and C.E. Ryan.)

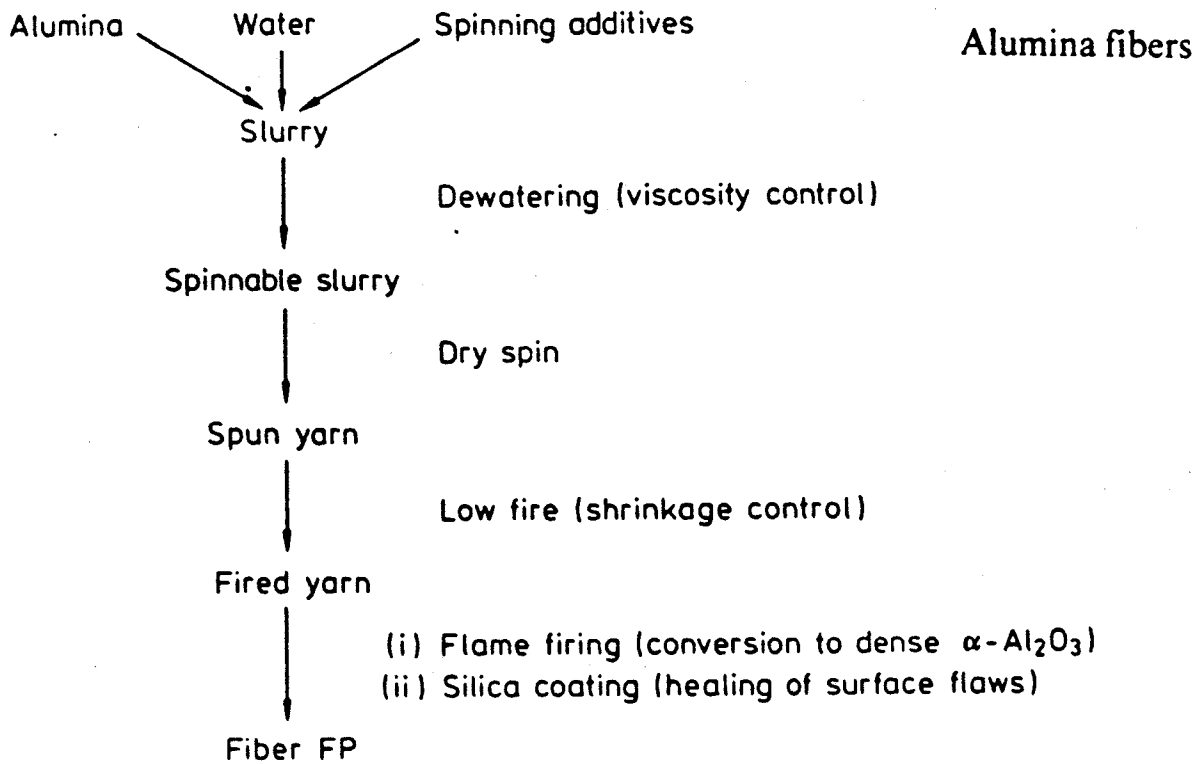


Fig. 2.37. Flow diagram of FP (Al_2O_3) fiber production. (Adapted from Ref. 55, used with permission.)

Table 2.6. Properties of fiber FP^a

Diameter (μm)	Density (g cm^{-3})	Tensile strength (MPa)	Young's modulus (GPa)	Melting point ($^{\circ}\text{C}$)
20 ± 5	3.95	1380	379	2045

^a $\alpha\text{-Al}_2\text{O}_3$.

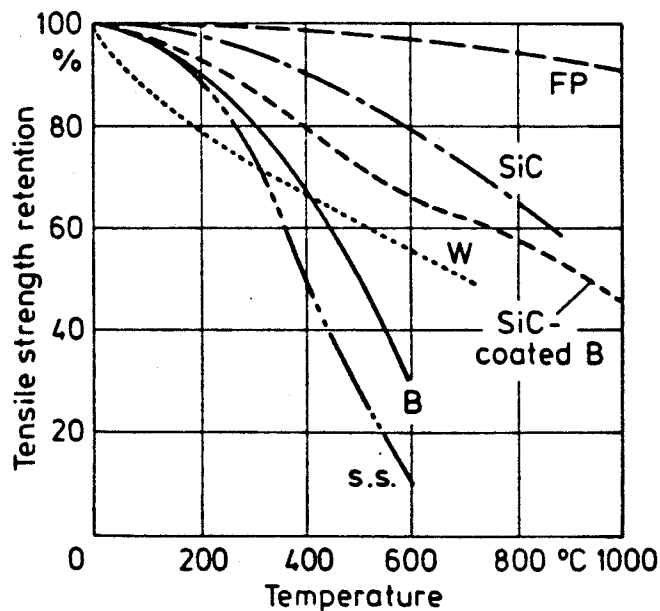


Fig. 2.39. Tensile strength retention at high temperature for some fibers. s.s. is stainless steel. (Adapted from Ref. 55, used with permission.)

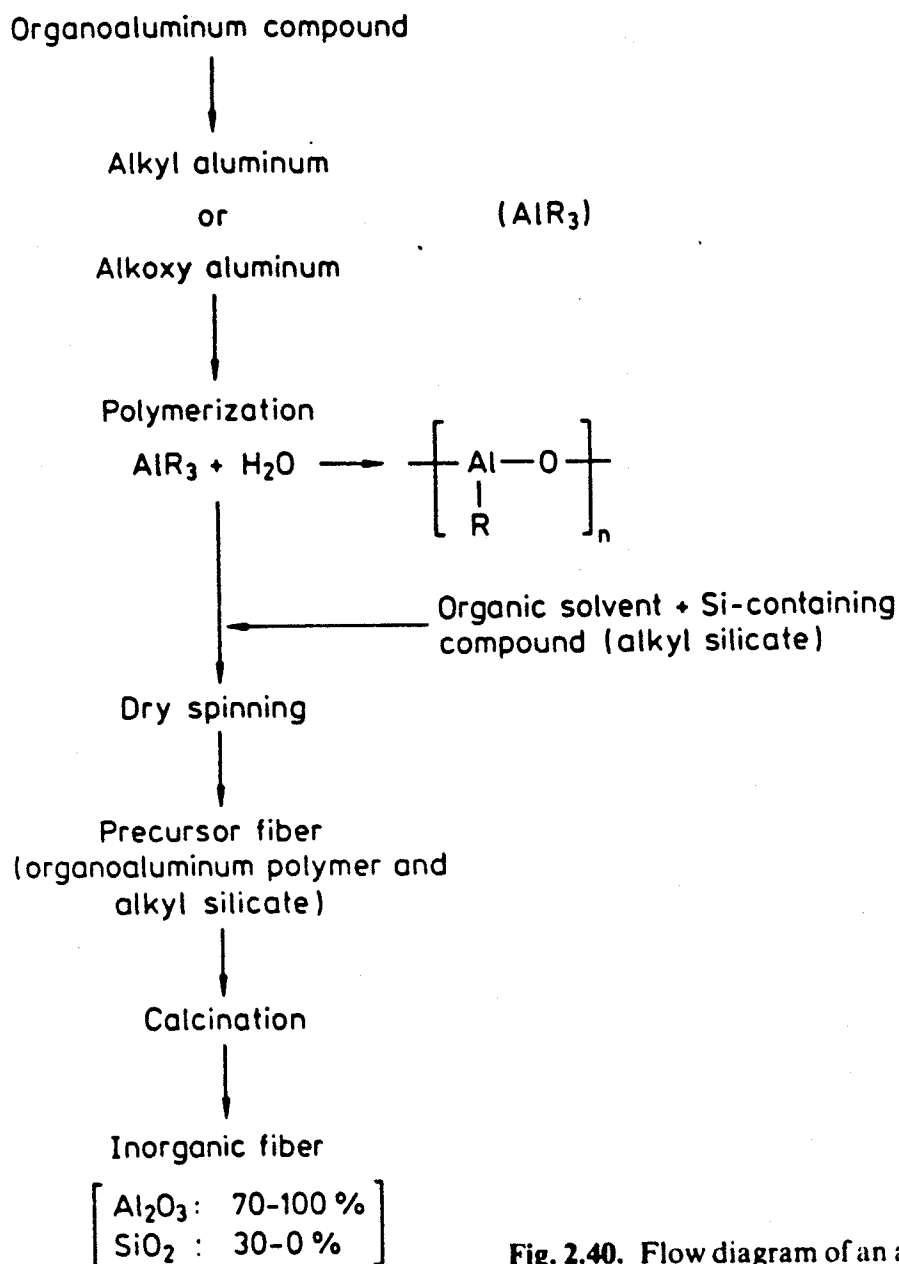
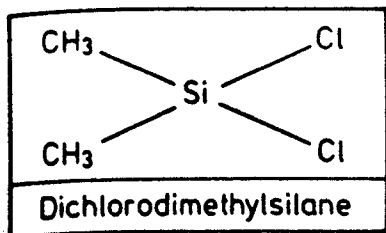


Fig. 2.40. Flow diagram of an alumina + silica fiber production

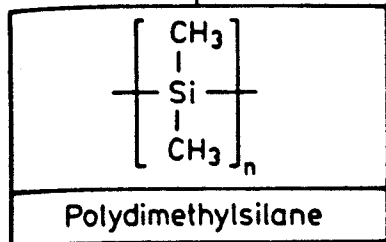
Table 2.7. Properties of some alumina type fibers

Fiber type	Composition	Diameter (μm)	Density (g cm^{-3})	Tensile strength (MPa)	Young's modulus (GPa)
Sumitomo*	Al ₂ O ₃ — 85% SiO ₂ — 15%	9	3.2	2600	250
Nextel 312 (3M Co.)	Al ₂ O ₃ — 62% B ₂ O ₃ — 14% SiO ₂ — 24%	3.5	2.7	1700	152
Saffil (ICI)	Al ₂ O ₃ — 96% SiO ₂ — 4%	3	3.3	2000	300

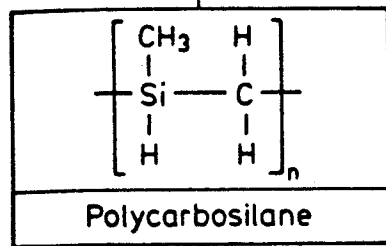
*Laboratory scale production.



Dechlorination
with Na (to NaCl)



Polymerization at
470 °C in autoclave



Melt spinning at
350 °C (N₂)

Polycarbosilane
fiber

Curing: 190 °C in air
or RT in ozone

Polycarbosilane fibers
with molecular cross-
linking by oxygen to
avoid subsequent
melting

Pyrolysis: heating to
1300 °C or less in
vacuum (100 °C/h)

SiC fiber
Amorphous or micro
crystalline β-SiC

Fig. 2.45. Schematic of SiC (Nicalon) production. (Adapted from Ref. 61, used with permission.)

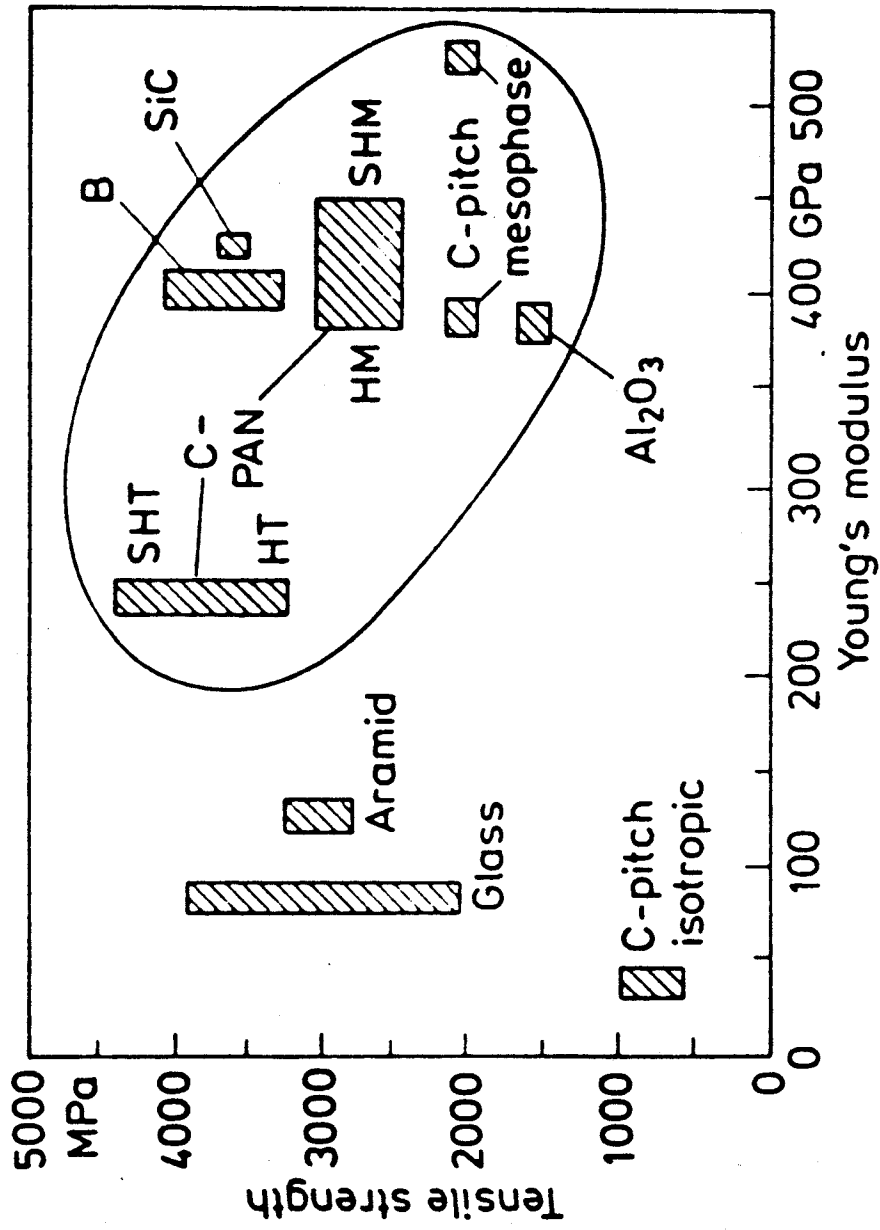


Fig. 2.50. Comparison of different fibers