



CHAPTER NO 1

CERAMIC FABRICATION PROCESSES:

Chemical
Composition

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graph TD; A[Chemical Composition] --> B(Ceramic Fabrication); A --> C(Intrinsic); B --> D[Microstructure]; C --> E[Properties]; D --> E;
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The diagram is a flowchart with five nodes. At the top is a rectangular box labeled 'Chemical Composition'. Two red arrows point downwards from this box to two ovals: 'Ceramic Fabrication' on the left and 'Intrinsic' on the right. From 'Ceramic Fabrication', a red arrow points to a rounded rectangular box labeled 'Microstructure'. From 'Intrinsic', a red arrow points to a rounded rectangular box labeled 'Properties'. Finally, a red arrow points from 'Microstructure' to 'Properties'.

Ceramic
Fabrication

Intrinsic

Microstructure

Properties

CERAMIC FABRICATION PROCESS

Table: Common Ceramic Fabrication Methods

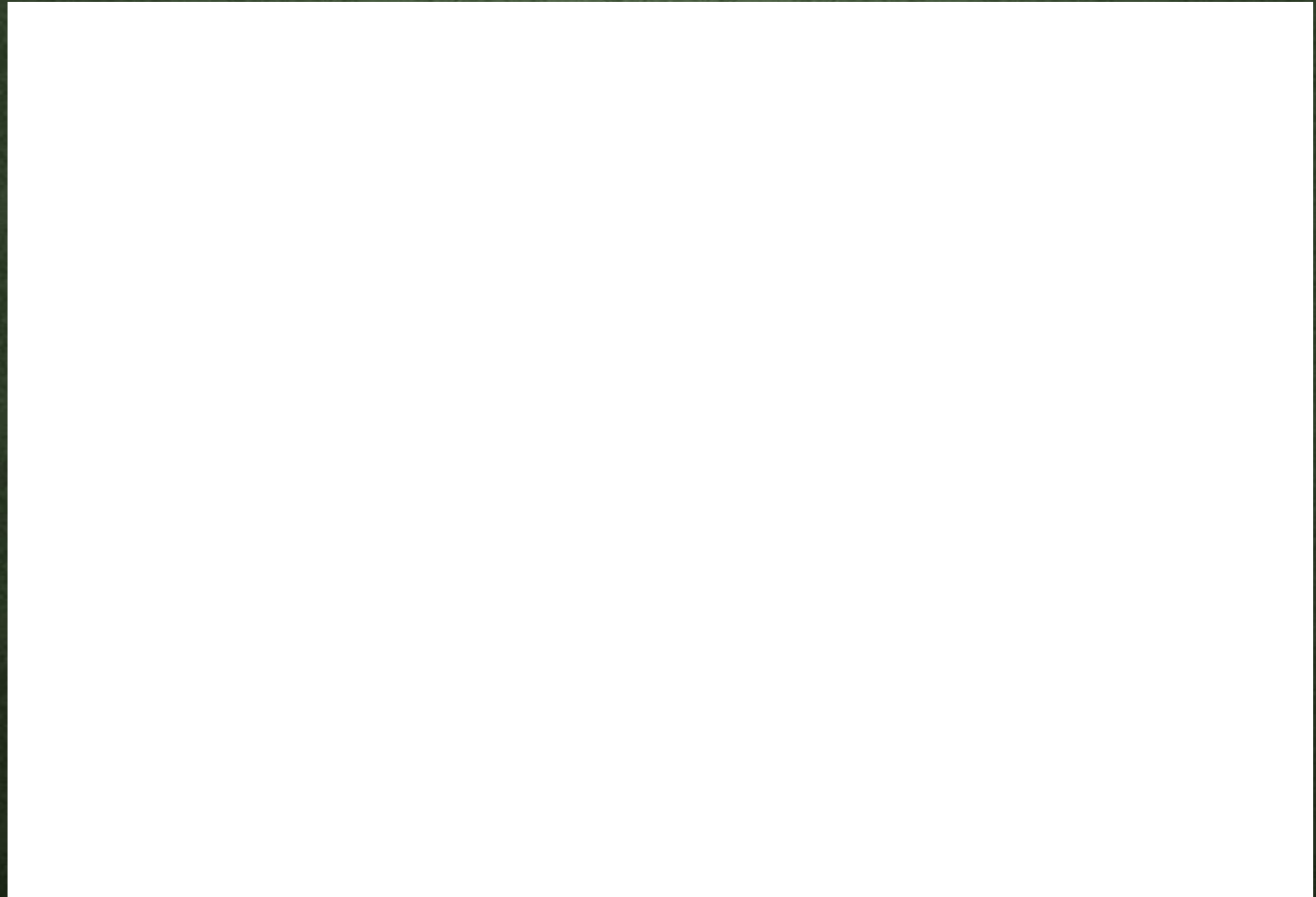
Starting materials	Method	Product
Gases	Chemical vapor deposition	Films, monoliths
Gas-liquid	Directed metal oxidation	Monoliths
Gas-solid	Reaction bonding	Monoliths
Liquid-solid	Reaction bonding	Monoliths
Liquids	Sol-gel process	Films, fibers
	Polymer pyrolysis	Fibers, films
Solids (powders)	Melt casting	Monoliths
	Sintering of powders	Monoliths, films

GAS-PHASE REACTIONS

- Chemical Vapor Deposition (gas reaction)
- Directed Metal Oxidation (liquid-gas reaction)
- Reaction Bonding (solid-liquid reaction)

CHEMICAL VAPOR DEPOSITION

Chemical vapor deposition in which the desired material is formed by chemical reaction between gaseous species.



FACTORS INFLUENCING THE CVD PROCESS

- The flow rate of the reactant gases.
- The nature and flow rate of any carrier gases.
- The pressure in the reaction vessel.
- The temperature of the substrate.

ADVANTAGES & DISADVANTAGES OF CVD METHOD

- **Advantage:**

- **Low reaction temperature.**

- **Disadvantage:**

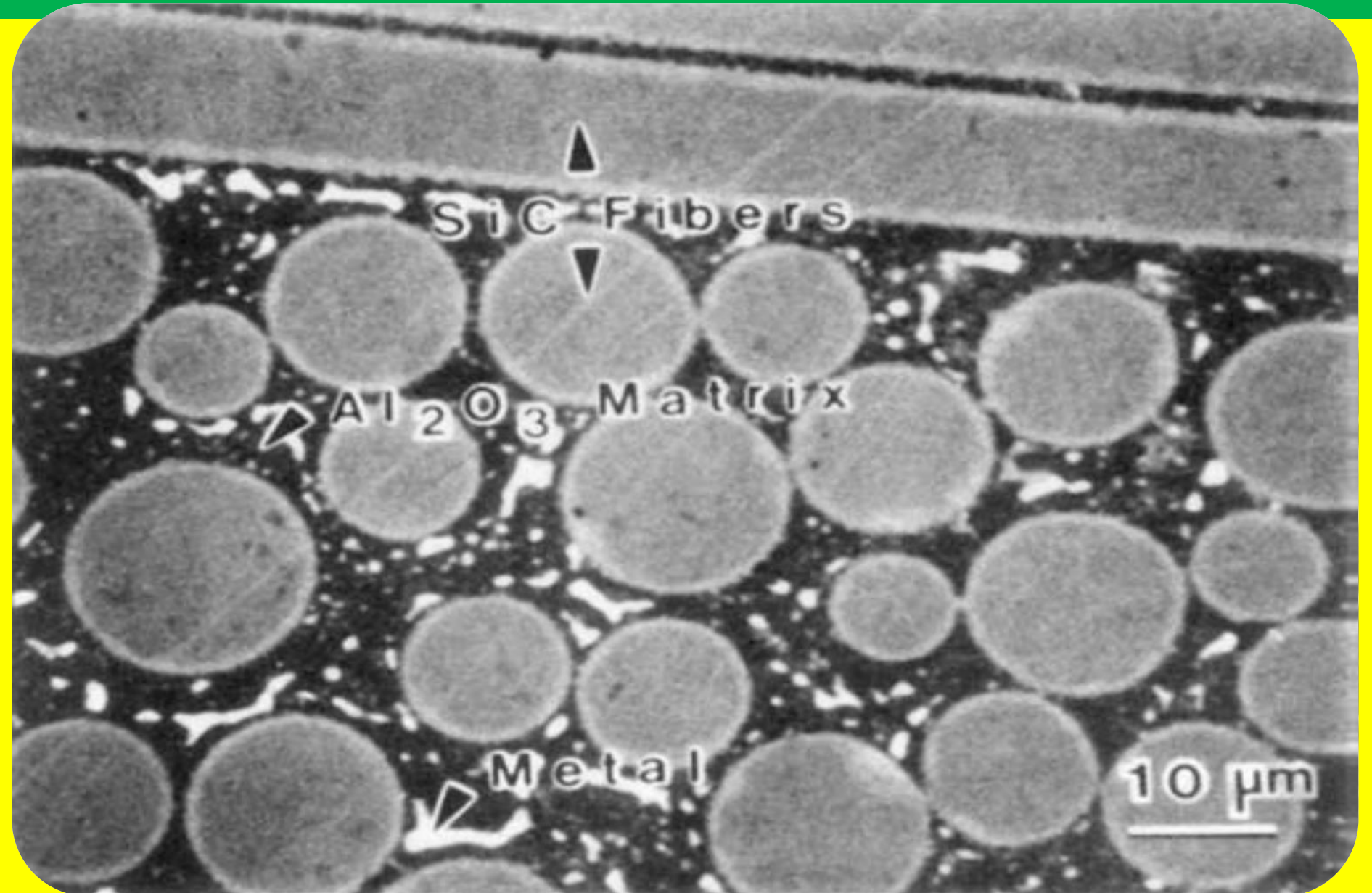
- **Time consuming method.**
- **Fabrication limited to thin films and coatings not suitable for monolithic bodies.**

DIRECTED METAL OXIDATION

The directed metal oxidation process is based on the reaction of a molten metal with an oxidizing gas.

DIRECTED METAL OXIDATION

Figure: Optical micrograph of an $\text{Al}_2\text{O}_3/\text{Al}$ matrix reinforced with SiC fibers produced by directed metal oxidation.



ADVANTAGES OF DIRECTED METAL OXIDATION

- ❑ The growth of the matrix into the preform involves little or no change in dimensions.
- ❑ No problems associated with shrinkage during densification.
- ❑ Large components can be produced readily with good control of the component dimensions.

REACTION BONDING

A reaction bonding route involving both gas–liquid and gas–solid reactions to produce the desired chemical compound and bonding between the grains.

REACTION BONDING

