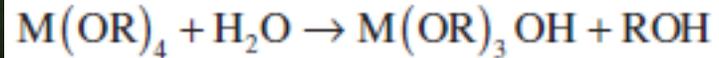


# LIQUID PRECURSOR METHODS

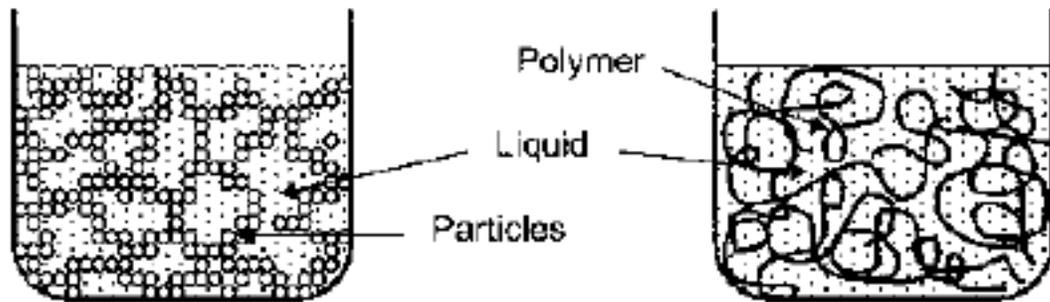
Fabrication routes in which a solution of metal compounds is converted into a solid body are sometimes referred to as *liquid precursor* methods. The sol–gel process has attracted considerable interest since the mid-1970s and forms the most important liquid precursor route for the production of simple or complex oxides.

# SOL-GEL PROCESSING

## Hydrolysis

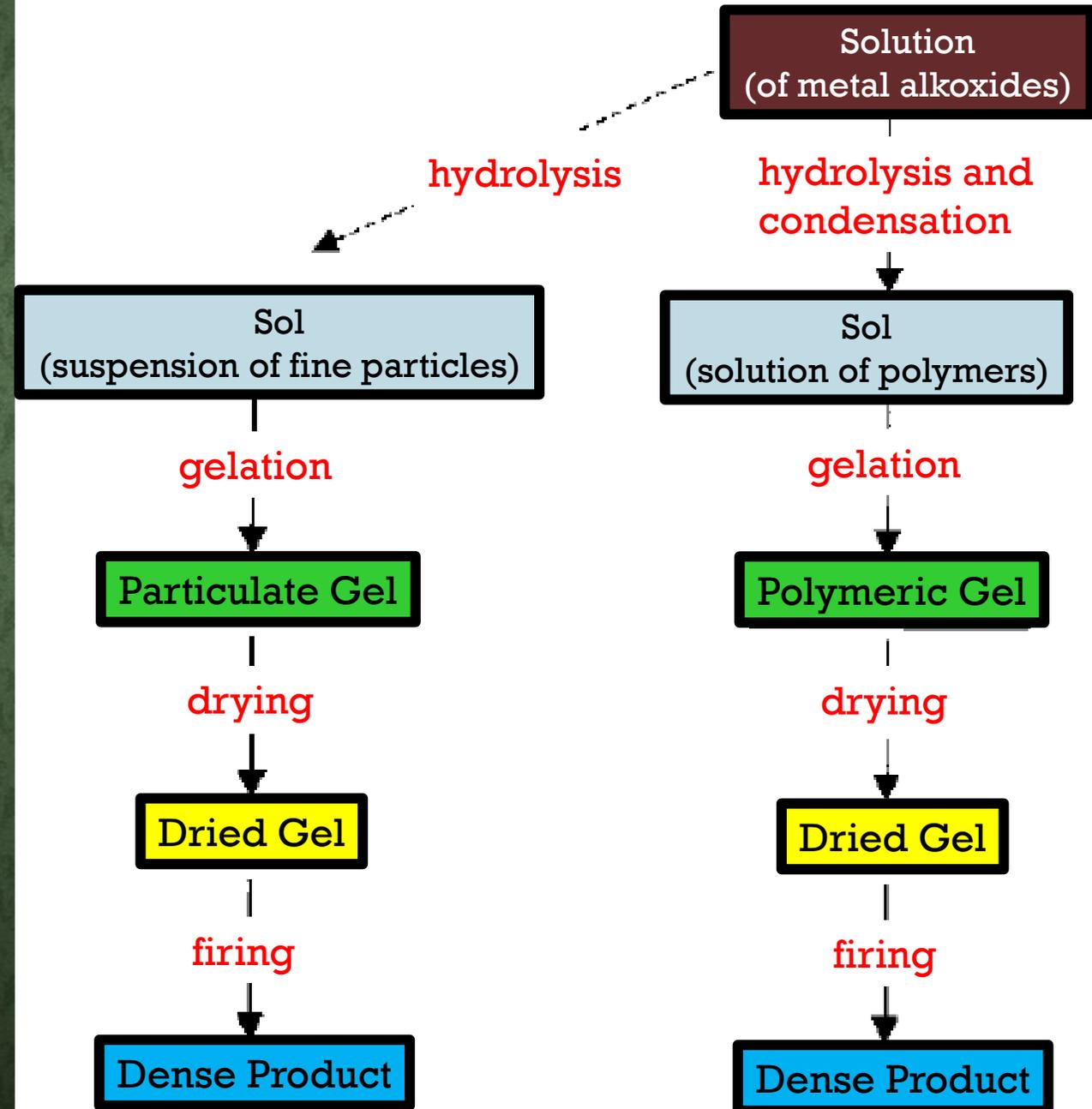


## Condensation



Particulate gel

Polymeric gel



# ADVANTAGES AND DISADVANTAGES OF SOL-GEL PROCESSING

- Advantages:

- Materials produced with high purity.
- Materials with exceptionally good chemical homogeneity.
- Low densification temperature.

- Disadvantages:

- The starting materials are expensive.
- Difficulties of conventional drying, cracking, warping, and considerable shrinkage problems.

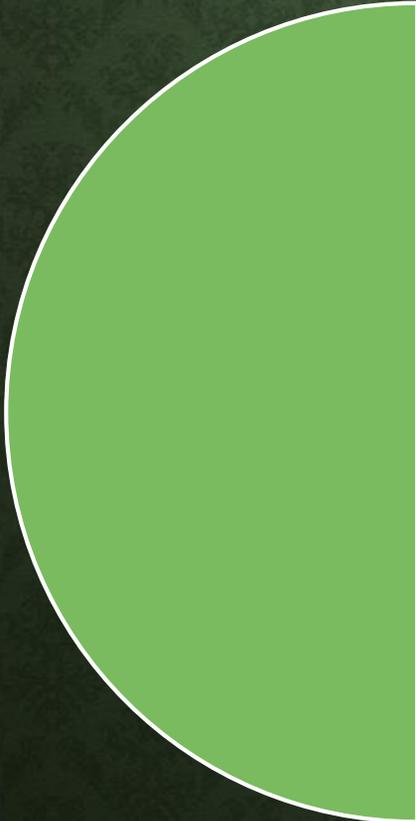
# **Fabrication from Powders**

```
graph TD; A[Fabrication from Powders] --> B[Melt casting]; A --> C[Firing of compacted powders];
```

**Melt casting**

**Firing of  
compacted  
powders**

# MELT CASTING



Melting followed by casting into shape, referred to simply as **melt casting**.

# DISADVANTAGES OF MELT CASTING

1. Uncontrolled grain growth
2. Either high melting points or decomposition prior to melting .

**Therefore, melt casting method limited to the fabrication of glasses.**

# ADVANTAGE OF MELT CASTING

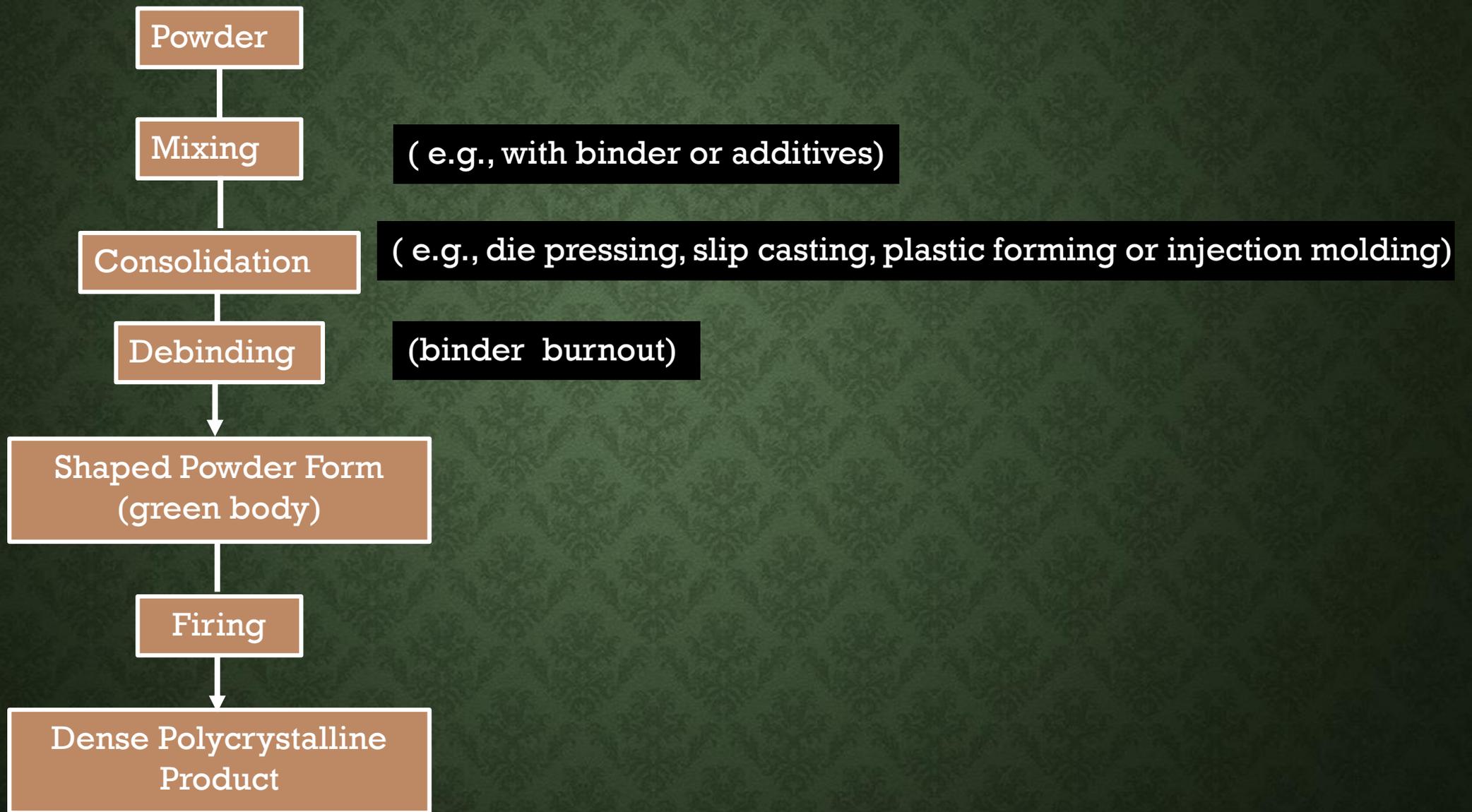
- An important variation of glass processing is the *glass ceramic route*.
- The glass is crystallized using a heat treatment consisting of two main steps:

Nucleation

Crystal growth.

# FIRING OF COMPACTED POWDERS

- This method involves the consolidation of a mass of fine particles to form a porous, shaped powder, which is then fired to produce a dense product.



**Figure: Basic flow chart for the production of polycrystalline ceramics by firing of consolidation of powder**

# **PRODUCTION OF POLYCRYSTALLINE CERAMICS FROM POWDERS: AN OVERVIEW**

The processing steps can be divided into two parts:

- *Processes prior to the firing of the green body.*
- *Processes occurring during firing.*

- 1. Powder Synthesis and Powder Characterization**
- 2. Powder Consolidation**
- 3. The Firing Process**
- 4. Ceramic Microstructures**