

Lithographic and Non-Lithographic Processes

Techniques for Nanostructure
Fabrication

Introduction



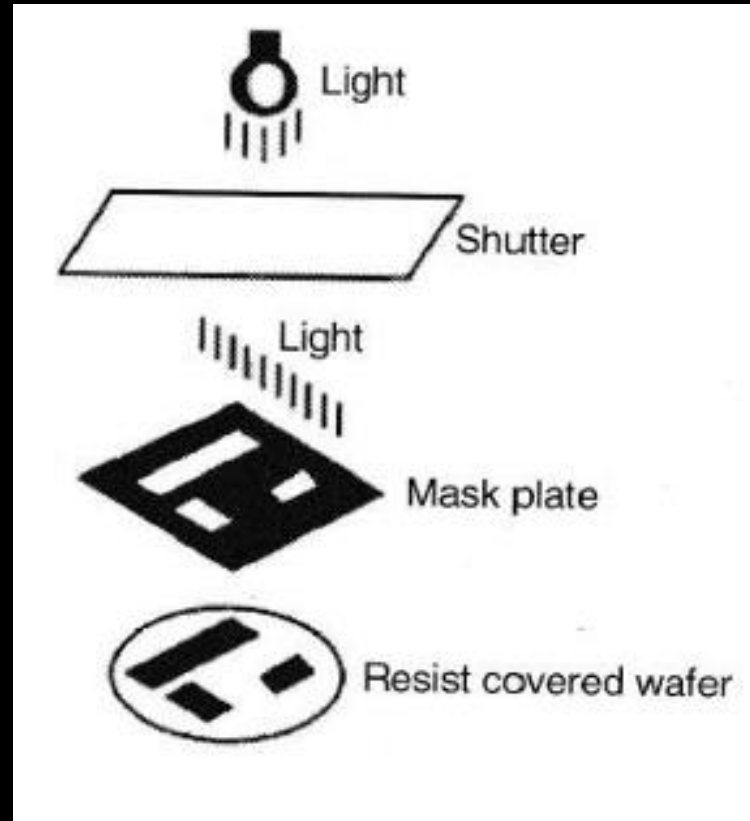
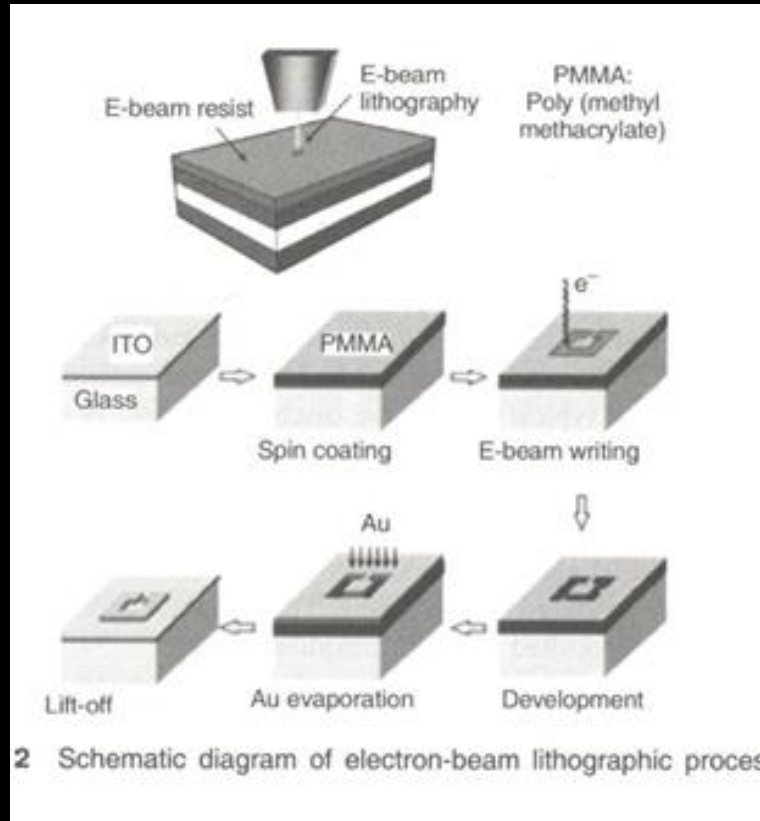
Lithographic and Non-Lithographic Processes are techniques for **nanosstructure fabrication**.

Lithographic Process: Uses chemical/mask-based patterning.

Non-Lithographic Process: Based on **self-organization and deposition techniques**.

Used in **semiconductor and nanomaterial industries**.

Lithographic Processes



1. Photolithography

Uses **light and a photomask** to transfer patterns onto a substrate.

Deep Ultraviolet (DUV) Lithography: Uses **248 nm & 193 nm light** for small features (**down to 50 nm**).

Used in: Fabrication of **silicon-based electronic & photonic devices**.

2. Electron Beam Lithography (E-Beam Lithography)

Uses **a beam of electrons** to create patterns at the nanoscale.

Advantages: Can overcome the **diffraction limit of light** and create **sub-20 nm** features.

Limitations: **Very slow**, mainly used in **research and mask-making**.

Non-Lithographic Process

Definition:

→ Fabrication technique based on **natural self-organization** rather than masks.

Types:

→ **Vacuum-Based Deposition Process**

→ **Solution-Based Deposition Process**

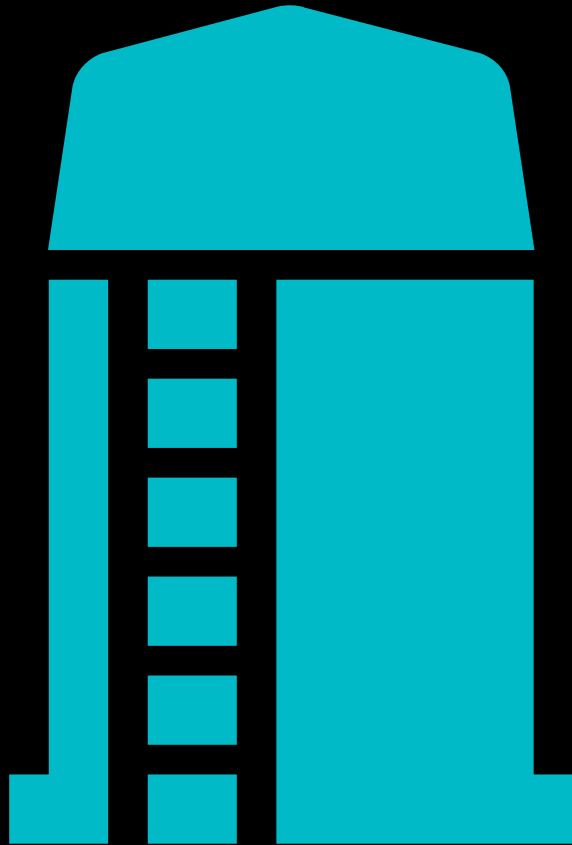
Advantages:

→ Cost-effective, flexible for nanomaterial synthesis.

Limitations:

→ Not yet fully integrated into industrial semiconductor fabrication.

Vacuum-Based Deposition Processes



→ **Deposition occurs in high vacuum (10^{-8} to 10^{-11} mbar).**

Advantages:

→ **Highly pure & clean** process with minimal contamination.

→ Suitable for **advanced device fabrication**.

Disadvantages:

→ Requires **expensive and complex equipment** (vacuum pumps, gauges, leak-proof accessories).

Examples:

→ **Plasma Arc Deposition**

→ **Evaporation**

→ **Sputtering**

→ **Chemical Vapor Deposition (CVD)**

→ **Molecular Beam Epitaxy (MBE)**

Solution-Based Deposition Processes

→ **Deposition occurs through chemical reactions in a liquid medium.**

Advantages:

→ **Simple, cost-effective**, and can synthesize a wide range of materials.

Disadvantages:

→ **Not as clean** as vacuum-based processes.

→ **Impurities** may affect material properties.

→ **Not fully compatible** with solid-state electronics.

Examples:

→ **Sol-gel Dip Coating**

→ **Spin Coating**

→ **Spray Pyrolysis**

→ **Electrodeposition**

→ **Chemical Bath Deposition**





Thank You
