

**Nano structured materials-synthesis, properties, self assembly and applications
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MODULE 2 (LECTURE 5 & 6): CVD and PVD

Problem :

1. What is chemical vapour deposition
2. What is the importance of deposition process.
3. What is the basic principle of CVD.
4. What are the basic physical and chemical steps involved during a CVD process.
5. What is Knudsen equation.
6. What are the different types of techniques by which CVD can be performed.
7. What are the materials that can be deposited by CVD
8. What is physical vapour deposition.
9. Applications of PVD.
10. What are the main categories of PVD processing.
11. What are the heat sources used in PVD.
12. Different variables to be monitored in PVD
13. What are the advantages of vacuum deposition.
14. What are the disadvantages of vacuum deposition.

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Solution :

1. Process whereby a thin solid film is deposited onto a substrate through chemical reactions of the gaseous species.
2. To synthesize nano layered materials, single and multi-layered films and coatings, functional coatings deposition technique has immense importance.
3. CVD depends on the availability of a volatile chemical which can be converted by some reaction into the desired solid film.
4. mass transport of reactant to vicinity of substrate, diffusion of reactant through the boundary layer to the substrate surface, adsorption of reactant on substrate surface, surface migration of coating atoms into the growing substrate, desorption of by-product on the surface reaction, diffusion of by-product to the bulk gas, transport of by-product away from substrate.
5. Knudsen equation: $J = 3.51 \times 10^{22} P / \sqrt{MT}$
M in g/mol
P in torr
J in molecules/cm² second
6. CVD reaction types: Pyrolysis, reduction, oxidation, compound formation, disproportionation, reversible transfer
7. Materials deposited by CVD: microelectronics, optoelectronics, protective and decorative coatings, optical coatings
8. Atomistic deposition processes in which material is vaporized from a solid or liquid source in the form of atom or molecules transported in the form of vapour through a vacuum to the substrate where it condenses.
9. Multilayer coatings, freestanding structure.
10. Vacuum deposition, sputter deposition, arc vapour deposition, ion plating.
11. Tungsten wire coils
12. Substrate temperature, deposition rate, vacuum environment (pressure, gas species), angle of incidence of depositing atom flux, substrate surface chemistry and morphology.
13. High purity films are easily deposited, technique is relatively inexpensive, vaporization source material can be in many forms.
14. Poor ability to deposit many alloys and compounds, poor deposit uniformity