

SLT#2 Chemical vapor deposition (CVD)

2.1	Describe briefly the principle of CVD. What are the advantages and disadvantages of atmospheric pressure CVD (APCVD), low-pressure CVD (LPCVD), and plasma-enhanced CVD (PECVD)?
2.2	List common CVD materials. Discuss the two different growth regimes in a CVD process by using a graphical representation. What is the influence of the temperature? How does the graph $\log(t_{\text{film}})$ vs. T^{-1} change with pressure variation?
2.3	What is the particular property of Si_3N_4 [1] that makes it special? Si_3N_4 can be deposited using CVD processes, as well as Atomic Layer Deposition (ALD). What are the main differences between CVD and ALD processes?
2.4	Explain which CVD method and conditions are used for the diamond deposition [2]. Compare silicon dioxide (SiO_2) films made by CVD and by thermal oxidation. In which application is more suitable to use thermally grown SiO_2 and why?
2.5	Why is CVD applied to deposit graphene or other 2D materials [3]? Plasma-enhanced CVD can be applied to form graphene – what is the role of plasma and its advantages and disadvantages?
2.6	Describe briefly the principle of electrodeposition [4]. When is electrodeposition preferred over CVD in MEMS? Give two examples and their use.

[1] Silicon nitride Si_3N_4 (or more generally, Si_xN_y) is a widely used material in the fabrication of integrated electronics and MEMS devices as cantilevers and nano-membranes, dielectric material (MEMS switches), and for the LOCOS process.

[2] Diamond is usually used as a heat sink for high-power laser diodes and transistors due to its unique combination of properties: diamond is a hard, chemically inert material with a high thermal conductivity but negligible electrical conductivity.

[3] Two-dimensional (2D) materials and their heterostructures offer tunable electrical and optical properties, primarily modifiable through electrostatic gating and twisting. Common 2D materials include graphene, hexagonal boron nitride, and transition metal dichalcogenides.

[4] Electrodeposition, also known as electroplating or electrochemical deposition, is an electrochemical process where a thin layer of a desired material is deposited onto a conductive substrate through the application of an electric field.