Assignment – 8
Fundamentals of Materials Processes

1. Atomistic model for multi-layer adsorption of ad-atoms onto a surface is governed by
   a. Langmuir Isotherm
   b. BET Isotherm
   c. Volmer-Weber model
   d. Structure-Zone model
2. Which of the following deposition condition will favor deposition of amorphous thin films?
   a. High substrate temperature, low deposition rate
   b. High substrate temperature, high deposition rate
   c. Low substrate temperature, low deposition rate
   d. Low substrate temperature, high deposition rate
3. Which of the following relationship between interfacial energies results in Stranski-Krastanov growth?
   a. $\gamma_{sv} > \gamma_{fs} + \gamma_{fv}$
   b. $\gamma_{sv} < \gamma_{fs} + \gamma_{fv}$
   c. $\gamma_{fs} > \gamma_{sv} + \gamma_{fv}$
   d. $\gamma_{fv} > \gamma_{fs} + \gamma_{sv}$
4. The Stoney formula can be used to measure
   a. Crystal structure of the film
   b. Optical properties of the film
   c. Stress in the film
   d. Thickness of the film
5. Thin film of Al is being deposited by sputtering at a pressure of ~ 1 m torr. The temperature of the substrate is 200C. The resulting morphology of thin film will have
   a. Zone 1 structure
   b. Zone T structure
   c. Zone 2 structure
   d. Zone 3 structure
6. What will be the critical thickness for the onset of Stranski-Krastanov growth if the lattice mismatch between substrate and epitaxial thin film is 5% and the strain in thin film after relaxation is 3%. Young's modulus of the epitaxial thin film is 8.5×10^{10} Pa and interfacial energy is 0.5 J /m^2.
   a. ~ 7.5 nm
   b. ~ 75 nm
   c. ~ 750 nm
   d. ~ 7.5 μm
7. Which one of the following can be used for in-situ monitoring of film thickness during deposition via PVD techniques?
   a. Atomic Force Microscopy (AFM)

b. X-ray Diffraction (XRD)
c. Quartz Oscillation Method (QMB)
d. Scanning Electron Microscopy (SEM)

8. During 'Ostwald ripening' process of growth and coalescence of stable nuclei
   a. A neck forms between two growing nuclei and matter is transported from bulk to neck regions
   b. Small nuclei shrink and the matter is transported to bigger nuclei which grow at the expense of smaller nuclei
   c. Nuclei of different shapes and sizes undergo surface migration and when two such nuclei merge they form a bigger nucleus
   d. Nuclei of all sizes grow at the same rate depending upon thin film deposition rate
9. According to Langmuir Isotherm for monolayer coverage of the substrate the rate of surface coverage depends on
   a. Temperature of substrate only
   b. fraction of covered surface only
   c. both temperature and fraction of surface covered
   d. none of the above
10. The contact angle between nucleus of thin film being deposited and the substrate for homo-epitaxial growth of thin film would be
    a. 0°
    b. 60°
    c. 90°
    d. 180°