

Minor II – CLL 727 Heterogeneous catalysis and Catalytic Reactors

Time: 11:00- 12:00 pm
M.M 20

Date: 28, March, 2019
LH 308

1. (a) Derive Kelvin equation for estimation of radius of the capillary based on thermodynamic principle. (4) (3)
- (b) For physical adsorption, write down the equilibrium equations for the adsorption /desorption on the bare surface, first, second and third layers and derive expression for the total number of layers formed. (4) (3)
2. TPR of NiO supported on TiO₂ catalysts is shown in Fig. below. On titania the multiple reduction peaks are obtained for nickel oxide. Explain the reason for multiple peaks obtained. Also what additional information can be obtained from the figure on metal support interaction?

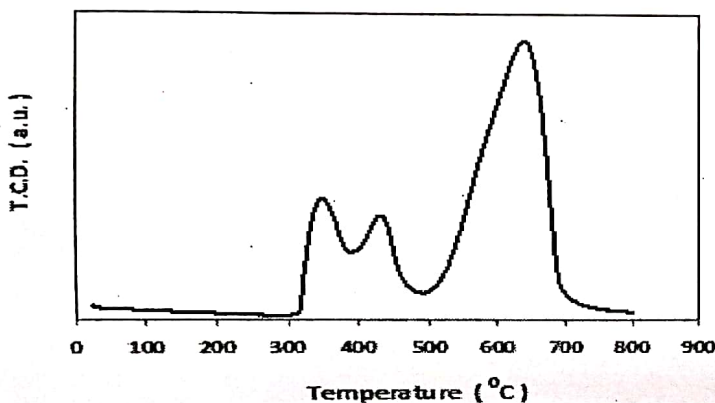


Fig. Typical TPR profile of nickel oxide supported on titania

(3) (4)

3. The true density of a solid material in an activated alumina particle is 3.875 g/cm³. The density determined by mercury displacement method is 1.647 g/cm³. The surface area by adsorption measurement is 280 m²/g. From this information, compute the pore volume per gram, the porosity of the particles and the mean pore radius. The bulk density of alumina is 0.88 g/cm³. What fraction of the total bed volume is void space between the particles and what fraction is the void space within the particles? 3 1/2 (5)
4. For an oxide material the TPD profile of ammonia desorption as a function of temperature is given below. What information can be derived from it? 2 (3)

