

Birla Institute of Technology & Science, Pilani – K. K. Birla Goa Campus

Second Semester, 2022 – 2023

CHEM F 326
Solid State Chemistry

MIDSEM EXAM (Closed Book) Max. Marks: 60
Date: 15/03/2023 Time: 1.5 hour

Instructions: There are two printed pages. Answer all the questions. Full Marks can be awarded only for completely correct answers. Illustrations should be done with pen only. Assume suitable parameter(s)/ data if necessary.

1. Answer the followings briefly.
 - (a) Explain the term 'Kirkendall effect'?
 - (b) Justify for the existence of Cr^{4+} which is octahedrally coordinated in SrCrO_3 instead of Cr^{3+} state.
 - (c) What is the number of formula units in the unit cell of CaF_2 ?
 - (d) The DTA plot of Kaolin gives an exothermic peak at higher temperature range of 950 -980°C, even if there is no weight loss in TG plot. Explain why?
 - (e) Name two common targets used in ESCA.
 - (f) How will you proof the local structures of each S atoms in $\text{Na}_2\text{S}_2\text{O}_3$?

[6 x 2]

- 2 (a) Considering the solid state reaction between MgO and Al_2O_3 to produce MgAl_2O_4 , write down balance chemical reactions occurring at left and right interfaces.

(b) Write down and justify two factors (major) which affect the rate of the solid state reactions. Write down two major points on the basic principle of hydrothermal method of synthesis?

[6+4]

- 3 (a) With the help of an appropriate diagram, describe a sol-gel method for the formation of Al_2O_3 solid using oxyhydroxides and colloid chemistry.

(b) Draw a diagram, label and explain the casting of thin film by vacuum evaporation method.

[6+ 6]

4 (a) With the help of a suitable diagram, derive Bragg's law, $2d\sin\theta = n\lambda$, for X-ray diffraction.

(b) Inter-planar spacings, $d(\text{\AA})$, and the corresponding Miller indices (hkl) obtained from the powder X-ray diffraction patterns for KI (cubic) are Tabulated below. Calculate, the average value of lattice parameters (up to fourth decimal) using the given data set.

d	4.08	3.53	2.49	2.13
(hkl)	(111)	(200)	(220)	(311)

[4+8]

5 (a) Draw the unit cells and label the cations and anions in ZnS and Na₂O materials.

(b) Proof that in cubic close packed structures, volume occupied by spheres is 74 % of the total volume.

(c) What is meant by 'absorption edge'. Draw a schematic diagram of UV-VIS spectrum and indicate absorption edge.

[4 + 6 + 4]

END