Exam Date & Time: 15-Jan-2024 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

VII SEMESTER B.TECH - END SEMESTER (MAKEUP) EXAMINATION- JAN 2024

Materials Characterization [MME 4074]

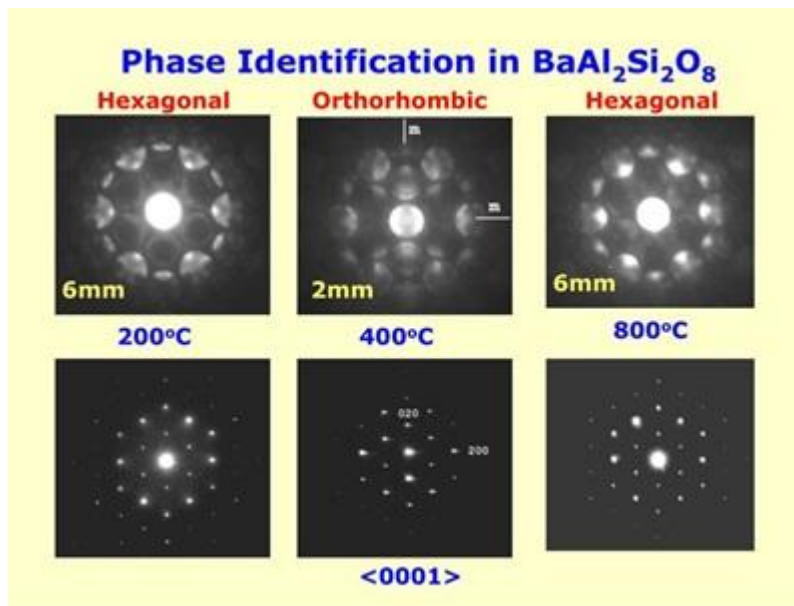**Marks: 50**   **Duration: 180 mins.**
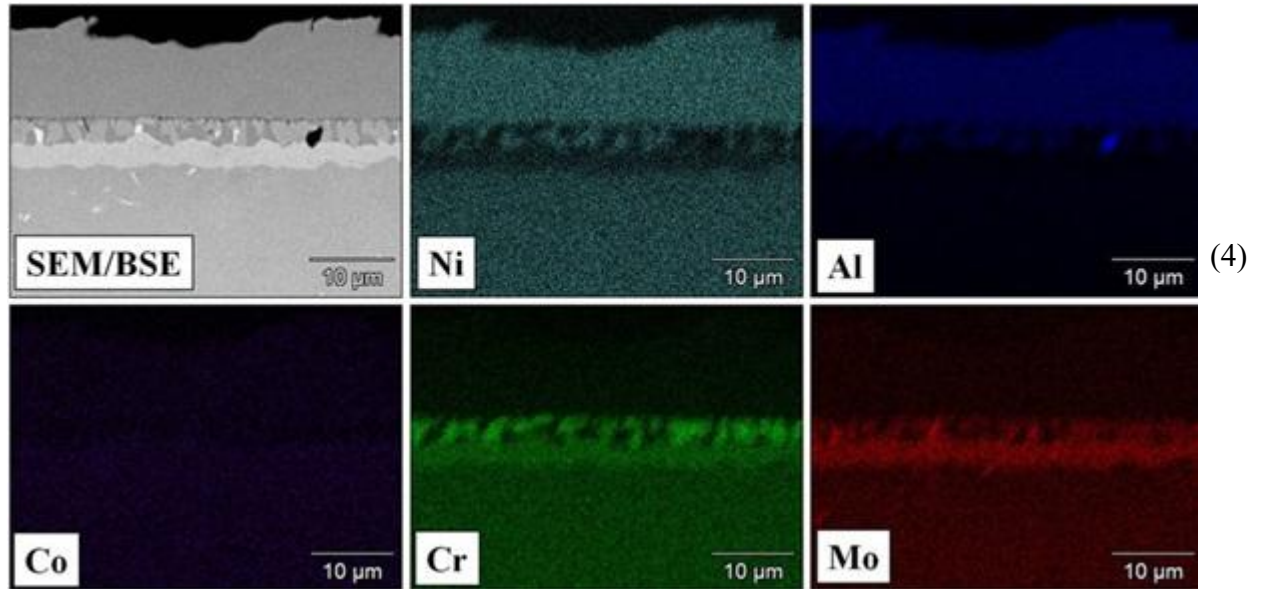
A

Answer all the questions.   Section Duration: 180 mins

Assume missing data and explain the assumption

1A)	SEM-EDS, TEM, XRD & XRF instruments are available in the materials testing laboratory. Identify the best and most suitable instrument if engineers want to understand the crystallographic information of unknown material. Describe the working principle of the selected instrument with cross section of the instrument.	(4)
1B)	ASTM grain size number 2 is better than that of ASTM grain size number 7. Discuss the same for pertaining to the component undergoing creep loading applications.	(3)
1C)	Discuss at least 2 different types of sample preparation techniques for the TEM analysis.	(3)
2A)	Deliberate the effect of surface roughness during sample preparation techniques for the optical microscope analysis.	(2)
2B)	Identify the suitable characterization technique provides the below images and discuss the given images.	(4)

2C)	The laser clad bearing shaft needs to be analysed for the coating thickness along with elemental chemistry. Suggest a suitable technique and describe its working procedure to characterize these coatings	(4)

3A)   SEM & EDS instruments are multipurpose materials characterization techniques. Justify
       the statement.   (3)

3B)   Deliberate the TEM instrument in understanding the materials characterization.
                                                                                                (3)

3C)   The below SEM/EDS analysis carried on the cross section of aluminized Hastelloy-X with
       ground surface in the as-received condition. Identify and discuss the material
       characterization technique and summary on the provided images.

(4)

4A)   Distinguish between FEG SEM & conventional SEM instruments.
                                                                                                (4)

4B)   Discuss the working principles of the XRD instrument.
                                                                                                (3)

4C)   Deliberate the vacuum requirements for the SEM & EDS instruments.
                                                                                                (3)

5A)   Final semester project work requires studying the effectiveness of cold working
       characteristics on the steel sheet samples. Which characterization instrument is suitable
       for the above work? Discuss the vital parts and their functions of the selected
       instrument.   (4)

5B)   Discuss 2 different techniques of XRF instrument.
                                                                                                (3)

5C)   Explain with a neat sketch the sample and X-Ray interaction in the XRD instrument.
                                                                                                (3)

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