Characterization of Adsorbents

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An adsorption based process gas recovery system is being developed in IPR to extract hydrogen isotopes from Helium gas at liquid nitrogen temperature. Adsorption is a surface phenomenon that involves concentration of a selected species in gas phase on the surface of a solid material due to unbalanced valence forces on the surface. Zeolites Molecular Sieves 5A and 13X have been considered as potential adsorbent material for this mass transfer operation.
Repeatability has been an issue in the field of adsorption sciences due to different manufacturing procedures and standards followed by different firms for the same material. This has a direct implication not only on the effectiveness of the adsorbent for the prescribed application but also on the cost. In this project work, the students would be involved in the characterization of Zeolites Molecular Sieves 5A and 13X purchased from two different vendors. The students would be required to perform the following analysis with standard instruments available at IPR:
1) SEM analysis to study the surface morphology and roughness, interparticle porosity, surface contamination, chemical composition of the adsorbents.
2) TEM analysis to study the internal crystal structure, structural defects or impurities, micropores, pore structure at 1-10 nm resolution in the adsorbents.
3) Powder XRD analysis to study the unit cell dimensions and crystallinity of the material
4) FTIR analysis for the assessment of functional groups present in the materials.
5) Hg porosimetry for porosity determination, meso & macro pores size distribution, macropore volume of the adsorbents.
6) Helium pycnometer for determination of both bulk and particle density of the materials.

Academic Project Requirements:

1) Required No. of student(s) for academic project: 2

2) Name of course with branch/discipline: B.E./B.Tech. Material Science/Engineering

3) Academic Project duration:

(a) Total academic project duration: 14 Weeks
(b) Student's presence at IPR for academic project work: 4 Full working Days per week

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