Specific Surface Area and Pore Size Distribution Characterization of ZIF Molecular Sieves

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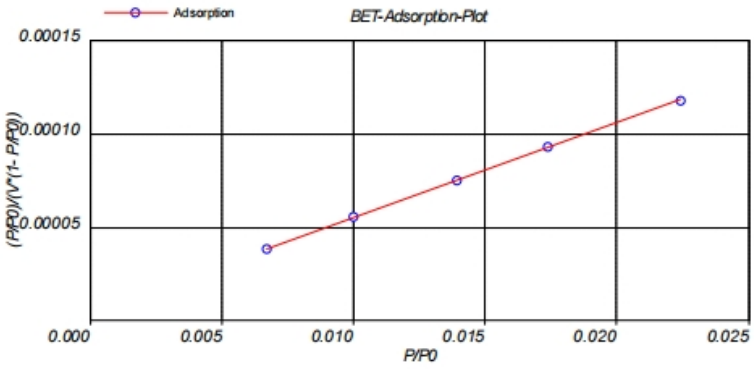
Zeolite imidazolium skeleton (ZIFs) materials as a subclass of metal-organic skeletons (MOFs), ZIFs materials combine the high stability of inorganic zeolites and the high specific surface area, high porosity and tunable pore size of MOFs materials, which can be applied to efficient catalytic and separation processes, so ZIFs and their derivatives have good potential for use in catalysis, adsorption and separation, electrochemistry, biosensor and biomedicine and other fields with good application prospects.

The following is a case study of the characterization of ZIF molecular sieves using **CIQTEK EASY-V series** specific surface and pore size analyzer. As shown in Fig. 3 left, the specific surface area of this ZIF molecular sieve is 857.63 m^2/g. The material has a large specific surface area which is favorable for the diffusion of reactive substances. From the N_2-adsorption and desorption isotherms (Fig. 3, right), it can be seen that there is a sharp increase in adsorption in the low partial pressure region ($P/P_0 < 0.1$), which is attributed to the filling of micropores, indicating that there is a certain amount of microporous structure in the material, and there is a hysteresis loop within the range of P/P_0 of about 0.40 to 0.99, which suggests that there is an abundance of mesoporous structure in this ZIF molecular sieve. The SF-pore size distribution graph (Fig. 4, left) shows that the most available pore size of this sample is 0.56 nm. The total pore volume of this ZIF molecular sieve is 0.97 cm^3/g, and the microporous volume is 0.64 cm^3/g, with 66% of micropores, and the microporous structure can significantly increase the specific surface area of the sample, but the molecular sieve will limit the catalytic activity under certain conditions due to the smaller pore size. However, under certain conditions, the smaller pore size will limit the diffusion rate of the catalytic reaction, which makes the performance of molecular sieve catalyst limited, however, the mesoporous structure can obviously make up for this defect of the microporous structure, so the structure of the combination of microporous-mesoporous can effectively solve the problem of the limitation of the mass transfer capacity of the traditional molecular sieve with a single pore.

Analysis Information

Mass:	0.0442 0 (g)	**Pretreatment:**	300°C, 6h
Method:			
Adsorption Temp.:	-196°C	**Multi-BET:**	857.630501 (m^2/g)
Analysis Time:			



BET Tabular Report

P/P0	Quantity Adsorbed(ml/g)	(P/P0)/(V*(1 - P/P0))	Single point BET
0.022434901832	195.202679482427	0.000117568969	830.553973961474
0.017402216528	191.843820516062	0.000092316849	820.464874578736
0.013921751751	188.768187274766	0.000074791751	810.170792459671
0.010020810684	184.292212060670	0.000054924968	794.089486759003
0.006737414325	178.942782906507	0.000037906614	773.596795401611
Slope	**Intercept**	**Vm(ml/g)**	**C Value**
0.005071018430	0.000003983132	197.044274331099	1274.123235849958
R	**Multi-BET Area**	**Langmuir Area**	
0.999979467381	857.630500774265	883.905475600822	

Analysis Information

Mass:	0.04420 (g)	Pretreatment:	300℃, 6h
Method:			
Adsorption Temp.	-196℃		
Analysis Time:			

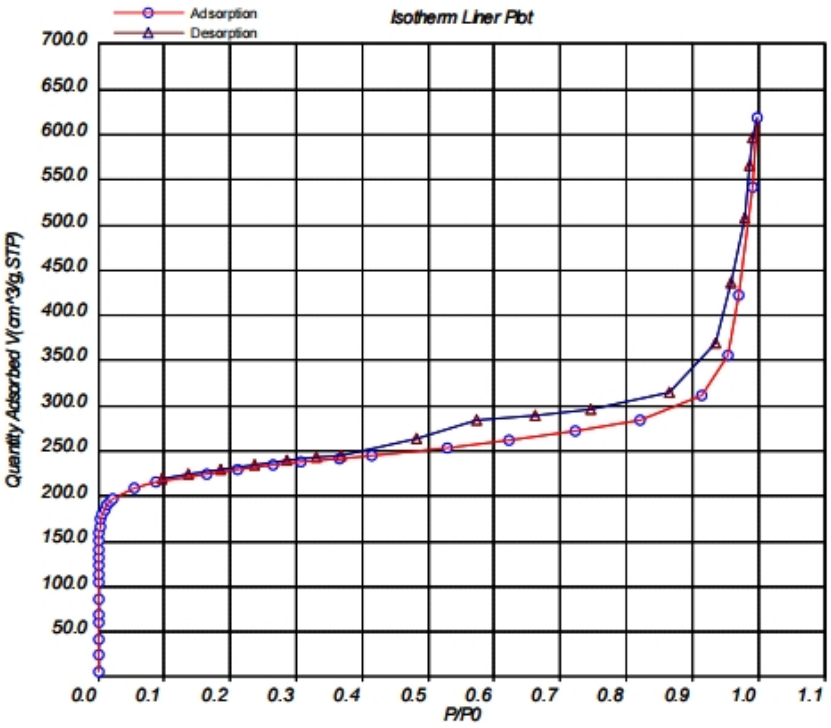
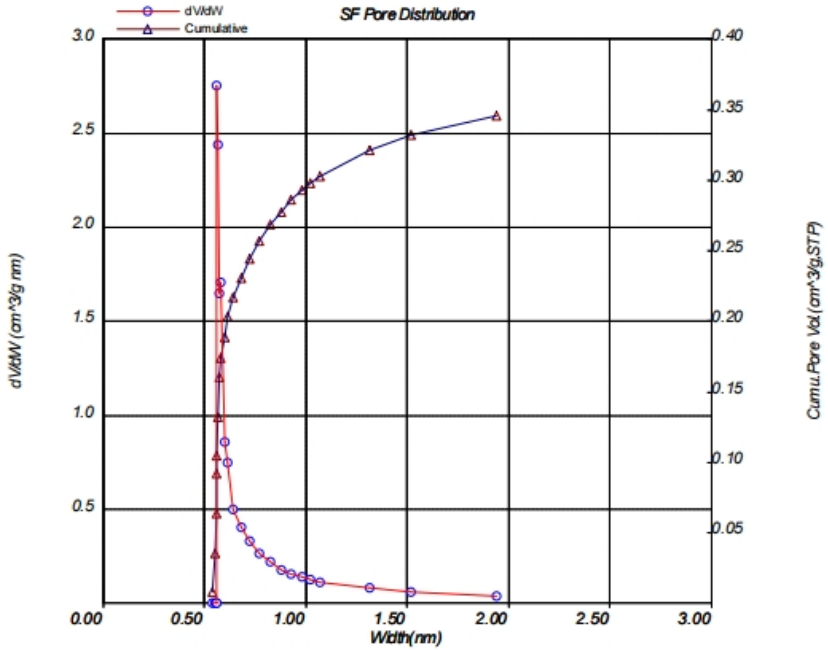


Fig. 1 Specific surface area test results (left) and N_2-sorption and desorption isotherms (right) for ZIF molecular sieves

Analysis Information

Mass:	0.04420 (g)	Pretreatment:	300℃, 6h
Method:			
Adsorption Temp.:	-196℃	Median Pore:	0.56448 (nm)
Analysis Time:			



Analysis Information

Mass:	0.04420 (g)	Pretreatment:	300℃, 6h
Method:		Model	N2@77K在氧化物表面上（圆柱孔）的模型
Adsorption Temp.:	-196℃	Lamba	1.47500
Analysis Time:		Median Pore:	1.20213 (nm)

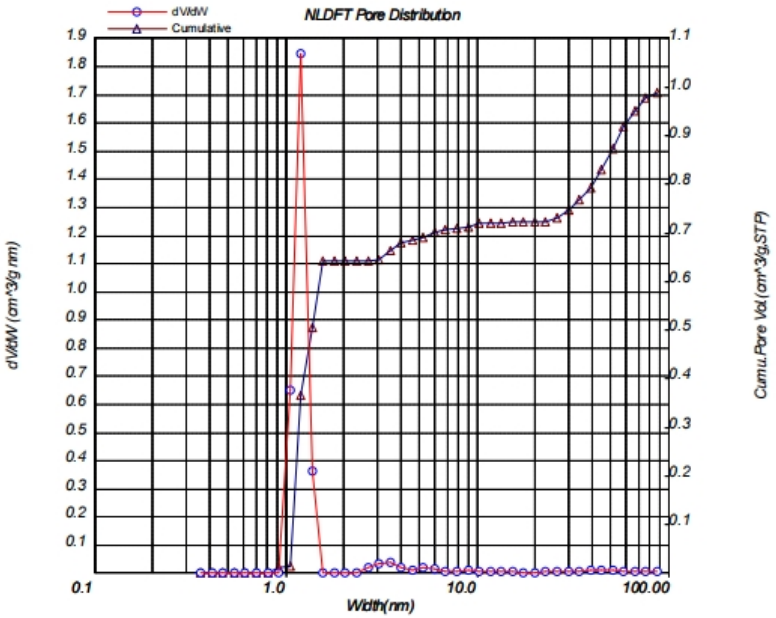


Fig. 2 SF-pore size distribution (left) and NLDFT-pore size distribution (right) of ZIF molecular sieve