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(/ / / / / /)

چکیده

(CPB) - α

- α (SEM) - bar - °C

واژه‌های کلیدی:

مقدمه

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Kresge

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de Vos []

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Tsai

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Thomas

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Zhong []

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(CPB)

- α

EDX

SEM

[-]

$$J_v = \frac{-r_p^2}{8\eta} \frac{P}{RT} \frac{dp}{dz} \quad ()$$

τ

ε

انتقال جرم درون غشاء معدنی متخلخل

$$J_v = \frac{-\varepsilon r_p^2}{\tau 8\eta} \frac{P}{RT} \frac{dp}{dz} \quad ()$$

L

$$Q_v = \frac{-J_v}{\Delta P} = \frac{\varepsilon r_p^2 P_m}{8\eta\tau RTL} \quad \text{where } P_m = (P_1 + P_2)/2 \quad ()$$

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ε/τ

(mol⁻¹g⁻¹Pa⁻¹) K

$$c = \rho q = \rho K_0 \exp\left(\frac{\Delta H_a}{RT}\right) P \quad ()$$

$$J_s = -\rho \varepsilon D_0(q) K_0 \exp\left(\frac{\Delta H_a}{RT}\right) \exp\left(\frac{-\Delta E}{RT}\right) \frac{dp}{dz} \quad ()$$

$$Q_s = Q_0 \exp\left(\frac{\Delta H_a - \Delta E}{RT}\right) \quad ()$$

$$Q_0 = \frac{\rho \varepsilon D_0(q) K_0}{L} \exp\left(\frac{\Delta H_a - \Delta E}{RT}\right) \quad ()$$

$$-\frac{P}{RT} \nabla x_i - \frac{x_i}{RT} \left(1 + \frac{B_0^e}{D_{k,i}^e} P\right) \nabla P = \sum_{j=1, j \neq i}^n \frac{x_j J_j - x_i J_i}{D_{ij}^e} + \frac{J_i}{D_{K,i}^e}, i=1, n \quad ()$$

$$D_{ij}^e = \frac{\varepsilon}{\tau} D_{ij} \quad , \quad D_{K,i}^e = \frac{4}{3} K_0^e \sqrt{\frac{8RT}{\pi M_i}} \quad ()$$

ε/τ K_0^e B_0^e

$$J_i = -\frac{1}{RT} \left(\frac{4}{3} K_0^e \sqrt{\frac{8RT}{\pi M_i}} + \frac{B_0^e}{\eta_i} P \right) \nabla P \quad ()$$

D= ×

$$D_{kn} = \left(\frac{\varepsilon d_p}{3\tau} \right) \left(\frac{8RT}{\pi M} \right)^{1/2} \quad ()$$

$$(J = -D_{(C)} \cdot \nabla C) \quad ()$$

$$J_{kn} = \frac{-2}{3} \cdot \frac{\varepsilon r_p}{\tau} \left(\frac{8}{\pi RTM} \right)^{0.5} \frac{dp}{dz} \quad ()$$

$$Q_{kn} = \frac{J_{kn}}{\Delta P} = \frac{2\varepsilon r_p}{3\tau L} \left(\frac{8}{\pi RTM} \right)^{1/2} \quad ()$$

r_p

$Q(MT)^{1/2}$

[]

$$\theta = \frac{q}{q_s} = \frac{bp}{1+bp} \quad ()$$

b

$$b = b_0 \exp\left(\frac{\Delta H_a}{RT}\right) \quad ()$$

ΔH_a
($bP \ll 1$)

$$q = q_s bp = KP = K_0 \exp\left(\frac{\Delta H_a}{RT}\right) P \quad ()$$

ΔE_c A

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آزمایش ها وسایل و مواد

(Merck) % / (Acros) %
 (Merck) %
 (Merck)
 % / % / % / % /
 % /
 -α
) %
 (

تهیه محلول

TEOS
 °C (pH = /)
 (pH = /)
 / : : / :

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$$Q_i = -\frac{J_i}{\Delta P} = \frac{1}{RTL} \left(\frac{4}{3} K_0^e \sqrt{\frac{8RT}{\pi M_i}} + \frac{B_0^e}{\eta_i} P_m \right) \quad ()$$

P_m Q_i

ε/τ_{mean}

$$\left(\frac{\varepsilon}{\tau}\right)_{DGM} = \frac{(K_0^e)^2}{2B_0^e} \quad ()$$

$$d_p = \frac{8B_0^e}{K_0^e} \quad ()$$

$$D_c = \rho_g d_p \sqrt{\frac{8RT}{\pi M_i}} \exp\left(\frac{-\Delta E_c}{RT}\right) \quad ()$$

$$J_c = -\frac{1}{RT} \frac{\varepsilon}{\tau} D_c \nabla P \quad ()$$

$$Q_c = -\frac{J_c}{\Delta P} = \frac{\rho_g d_p}{L} \frac{\varepsilon}{\tau} \sqrt{\frac{8}{\pi MRT}} \exp\left(\frac{-\Delta E_c}{RT}\right) \quad ()$$

$$Q_c = \frac{A}{L} \sqrt{\frac{8}{\pi MRT}} \exp\left(\frac{-\Delta E_c}{RT}\right) \quad (23)$$

$$A = \frac{\rho_g d_p \varepsilon}{\tau} \quad ()$$

تهیه غشاء

-α

ρ_g

مدول غشایی و سیستم آزمایشگاهی
()

[-]

°C
/ °C.min⁻¹

°C

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(

cm³/min

SEM

Philips XL30

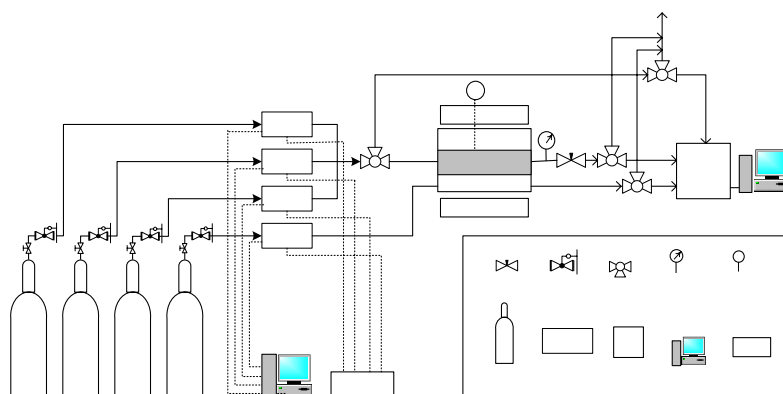
(BET)

cc/min

D5111(M+W)

Micro

meritics ASAP2000



:

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- °C

- bar

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(GC)

TCD

Philips PU4410 series

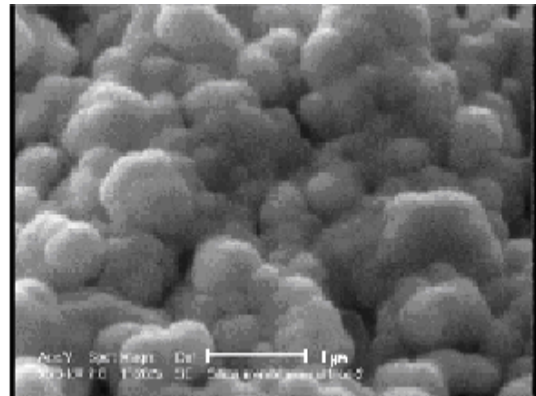
Hayesep N

/ / (P/P₀)

I

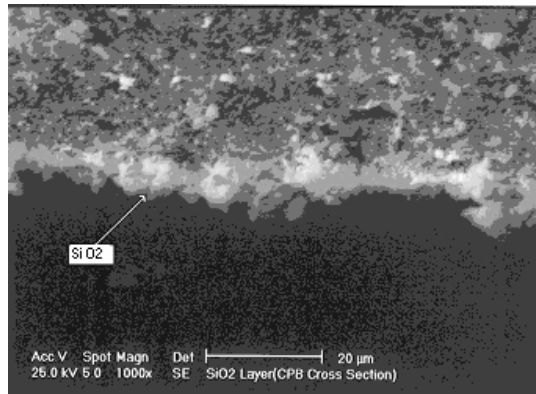
BET BJH

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(m ² g ⁻¹)	(cm ³ g ⁻¹)	(nm)
	/	/



نفوذ پذیری

Q (molm⁻²s⁻¹pa⁻¹)

(Q = -J/ΔP)

α_{ij}

(P_{ij}=Q_i/Q_j)

$$\alpha_{i/j} = \frac{y_i^{\text{permeate}}}{y_j^{\text{permeate}}} \cdot \frac{y_j^{\text{retentate}}}{y_i^{\text{retentate}}} \quad ()$$

A

B

y_B^A

-

(GC)

پایه α-آلومینا

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SEM :

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نتایج و بحث

مشخصات غشاءها

SEM

EDX

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x

	ε/τ	
/	/	
/	/	
/	/	

غشا سيلیکا

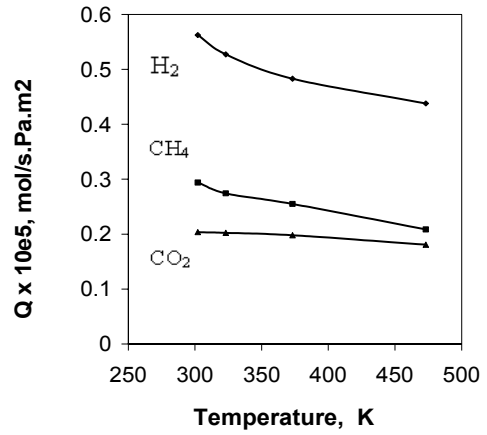
()

(/ Å)

(/ Å)

($\mu_{CH_4} < \mu_{CO_2}$)

$$\frac{1}{Q_{\text{membrane}}} = \frac{1}{Q_{\text{support}}} + \frac{1}{Q_{\text{silica}}} \quad ()$$



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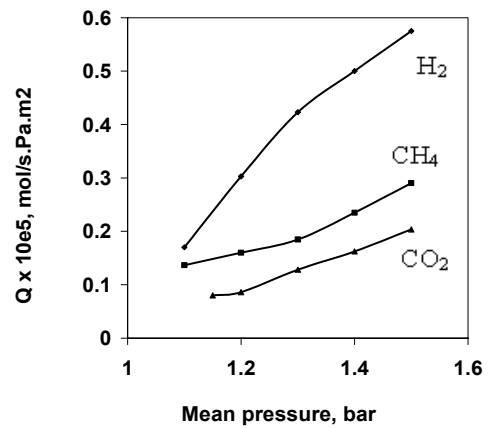
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$$\ln(\sqrt{T} Q_c)$$

$$\ln(\sqrt{T} Q_c) = \ln\left(\frac{A}{L} \sqrt{\frac{8}{\pi MR}}\right) - \frac{\Delta E}{R} \left(\frac{1}{T}\right) \quad ()$$

$$\frac{\ln(\sqrt{T} Q_c)}{1/T}$$

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()

()

()

() / bar

°C

()

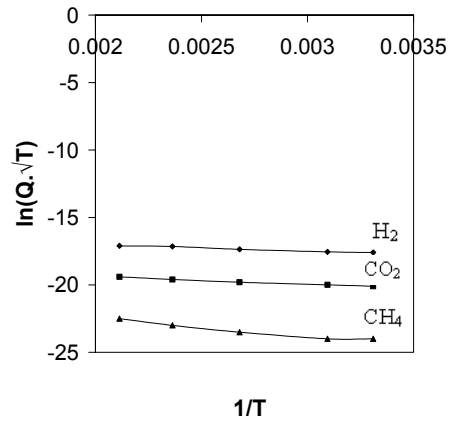
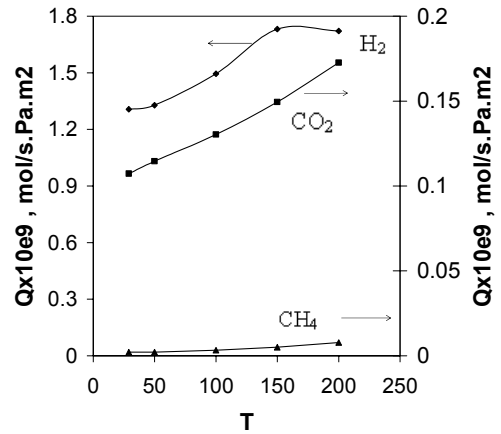
de Vos

Tsai [] (KJ/xmol) Verweij
 [] (/ KJ/mol)

Tsai (/ KJ/mol)

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جداسازی گاز



$Ln(\sqrt{T} Q_c)$

/ °C ()

°C

CO ₂ /CH ₄	H ₂ /CO ₂	H ₂ /CH ₄	
/	/		

$(\sqrt{M_j} / \sqrt{M_i})$

CO₂/CH₄ H₂/CO₂ H₂/CH₄

/ / /

	(Kj/mol) ΔE _C	(m) A	
/	/	/ * -	
/	/	/ * -	
/	/	/ * -	

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مقایسه دو غشاء حاوی ماده قالب و بدون ماده قالب

(/ KJ/mol) Thomas

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[] Kusakab

[] Li

$H_2/CO_2 = H_2/CH_4 =$)

($CO_2/CH_4 =$

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() ()

بحث و نتیجه گیری

$-\alpha$

$(m^2 g^{-1})$	$(cm^3 g^{-1})$	(nm)
	/	/

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فهرست علائم

	(m^2)	B_0^e			
	(Pa^{-1})	b			•
	(Pa)	P			
	$(m^2 s^{-1})$	D_{ij}			
	$(m^2 s^{-1})$	D			
	$(m^2 s^{-1})$	$D_{K,i}^e$			
	(m)	d_p			
$(J.mol^{-1}.K^{-1})$		ΔE_c			•
	$(J.mol^{-1})$	ΔH_a			
	$(mol.m^{-2}.s^{-1})$	J			
	(m)	K_o^e	CO_2/CH_4	H_2/CO_2	H_2/CH_4
	$(g.mol^{-1})$	M			
		P_{ij}			•
		q			
		q_s			
$(mol.m^{-2}.s^{-1}.pa^{-1})$		Q	(ΔP))
	(m)	r_p			
$(J.mol^{-1}.K^{-1})$		R			
	(K)	T			
		x			
		ε			
$(Pa.s)$		η			تقدير و تشكر
$(Kg.m^{-3})$		ρ			
		ρ_g			
		τ			
		α			

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واژه های انگلیسی به ترتیب استفاده در متن

- | | |
|-------------------------------------|---------------------------------------|
| 1 - Template | 2 - Template technique |
| 3 - Viscous flow model | 4 - Knudsen diffusion model |
| 5 - Surface diffusion model | 6 - Dusty gas model |
| 7 - Configurational diffusion model | 8 - Gas translational diffusion model |
| 9 - Critical micellar concentration | 10 - Membrane Characterization |
| 11 - Brunauer-Emmett-Teller | 12 - Pore |
| 13 - Permeation | 14 - Permselectivity |