

مدل سازی رفتار فازی مخلوط دوتایی نفت سنگین / بیتومن و حلال

1399/02/27 :

1397/10/02 :

چکیده

ES-SAGD VAPEX

1000

(k_{ij})

(T_{co}/T_{cs})

k_{ij}

3%

k_{ij}

.VAPEX

کلمات کلیدی:

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²VAPEX ¹SAGD

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SAGD .]13 12

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SAGD

VAPEX .]5[

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1. Steam Assisted Gravity Drainage
2. Vapor Extraction



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- k_{ij}

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SRK

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- - (k_{ij})

) (

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]26[

1

³ ABVB

2

2

 k_{ij}

381 °C -3/9 22000 kPa

597/3 g/mol 400

1/074 0/8912

مدل سازی

نمودار فازی مخلوط‌های دوتایی

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داده‌های تجربی

1

1. Advanced Peng-Robinson EoS (APR-EoS)
2. Tuning
3. Athabasca Bitumen Vacuum Bottoms

40

1148

		/	
]28[	$N_2/CO_1/C_2$		1
]29[	C_2/C_1		2
]30[	$N_2/CO_1/C_2/C_2$		3
]31[	CO_2		4
]32[	CO_2		5
]33[	CO_2		6
]34[	CO_2		7
]35[	C_3		8
]36[	C_3		9
]37[	nC_{10}	ABVB	10
]38[	C_3		11
]39[	C_3		12
]40[	CO_2		13
]41[	C_3		14
]42[	C_4		15
]10[	C_3		16
]21[	$nC_3/C_3/C_2/C_1/CO_2$		17
]43[	C_3		18
]44[	nC_4/C_3		19
]45[	nC_4/C_3		20
	C_1/CO_2		21
]46[	C_1/CO_2		
]47[	C_1		22
]48[	CO_2		23
]49[	C_3		24
]50[	C_3		25
]51[	CO_2		26
]7[	nC_4		27
]52[	CO_2		28
]22[	nC_4		29
]15[	C_3	WC-B-B3	30
]53[	nC_4/CO_2		31
]23[	nC_3	WC-B-B3	32
]54[	C_3		33
]55[	CO_2		34
]56[	C_2/CO		35
]57[	$C_2/C_1/CO_2/CO/N_2$		36
]58[	$C_2/C_1/CO_2/CO/N_2$		37

$$L_2 L_1 \quad L_1 V + L_2 V \quad V \quad - \quad 1$$

$$L_1 L_2 V \quad 1 \quad ($$

$$L_1 = V \quad L_1 \quad V$$

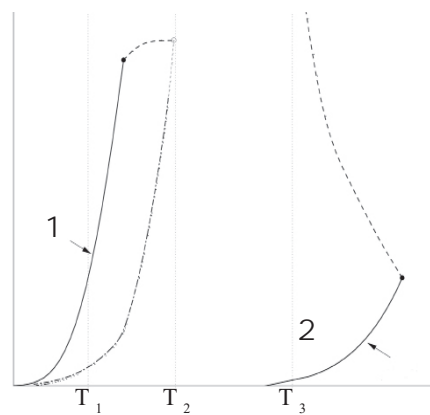
$$L_1 V \quad)2 \quad (\quad ^1 (UCEP)$$

$$) (\quad UCEP$$

$$UCEP$$

$$L_2/L_2 \quad V \quad V/L_2 \quad V \quad L_2 V$$

$$) ($$



$$:]60[$$

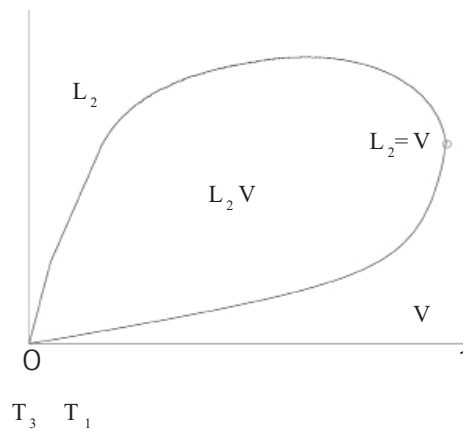
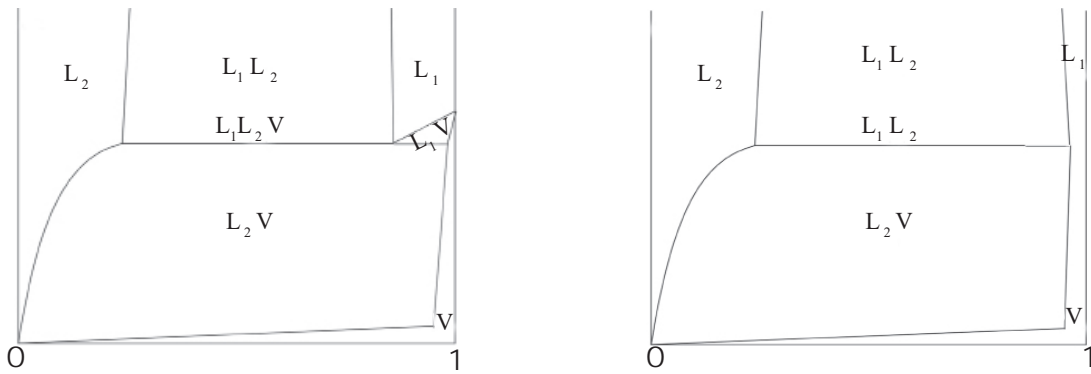
$$F=2+n-\pi \quad \pi \quad N \quad F \quad)1(\quad (L_1=L_2+V)$$

$$T_3 \quad T_1 \quad 2 \quad 1 \quad -$$

$$) - (2 \quad UCEP \quad T_3 \quad T_1$$

$$2$$

معادله حالت L_1
 $V \quad L_2$



$$a = \frac{0.457235 R^2 T_c^2}{P_c}$$

$$b = \frac{0.077796 T_c}{P_c}$$

[14]

[62]

SRK

[63]

$$v^{cor} = v - c + \delta_c \left(\frac{0.41}{0.41 + \lambda} \right)$$

$$\lambda = \frac{1}{RT_c} \left(\frac{\partial P}{\partial \rho} \right)_T$$

$$\rho = \frac{c_\delta}{T_c}$$

)6(

)7(

$$P_c \quad T_c$$

)8(

)9(

v^{cor}

$$P = \frac{RT}{v - b} - \frac{a\alpha}{v(v + b) + b(v - b)} \quad]2($$

$$\alpha = \frac{b a}{v}$$

$$\alpha = [1 + m(1 - T_r^{0.5})]^2 \quad]3($$

$$m = 0.37464 + 1.542226\omega - 0.26992\omega^2 \quad]4($$

$$m = 0.3796 + 1.485\omega - 0.1644\omega^2 + 0.01666\omega^3 \quad]5($$

b a

[66]

WinProp

[64]

b a

$$a = \sum_i \sum_j x_i x_j a_{ij} \quad (10)$$

$$b = \sum_i x_i b_i \quad (11)$$

$$a_{ij} = x_i x_j$$

Coal-Tar

$$a_{ij} = \sqrt{a_i a_j} (1 - k_{ij}) \quad (12)$$

$$k_{ij} = \frac{1}{2} (k_{ji} + k_{ij})$$

$$k_{ij} = \frac{1}{2} (k_{ji} + k_{ij}) \quad (13)$$

1

100

محاسبات تعادل فازي

$$1 - k_{ij} = \left[\frac{2\sqrt{T_{Ci} T_{Cj}}}{T_{Ci} T_{Cj}} \right]^n \quad (13)$$

[67]

n
[21 14]

0/27

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روابط تجربی

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بهینه‌سازی

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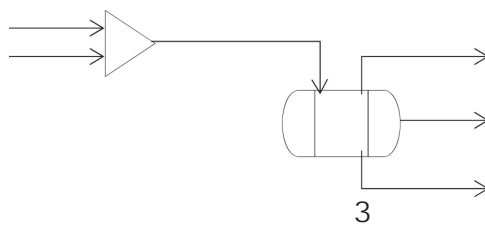
 k_{ij}

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(

]68[

]69[

 k_{ij} k_{ij} 

$$L_2 V / L_2$$

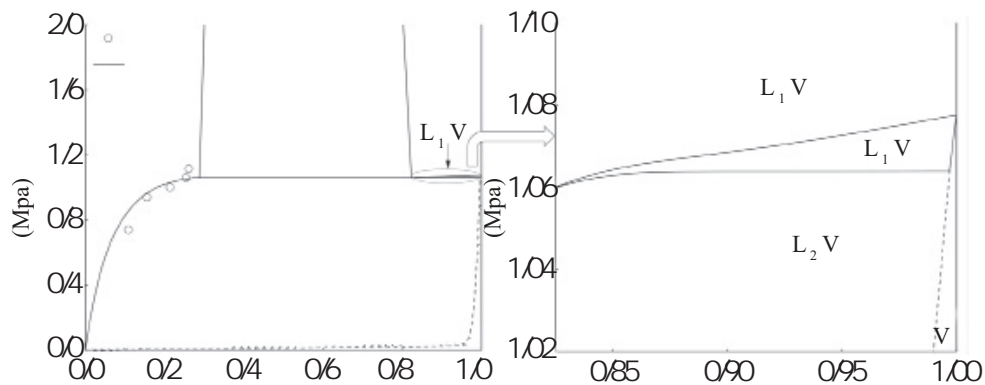
$L_1 V$

$$MSE = \frac{1}{n} \sum_{i=1}^n (P_{\text{expi}} - P_{\text{modeli}})^2 \quad (14)$$

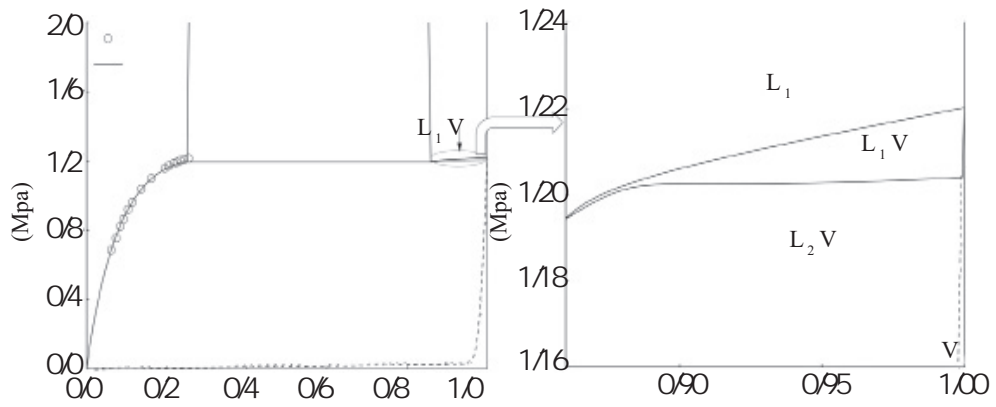
P_{modeli} P_{expi} n

MATLAB
fminsearch

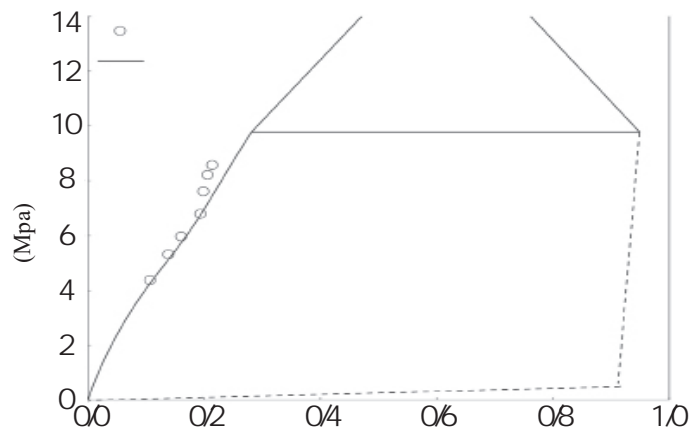
نتایج و بحث



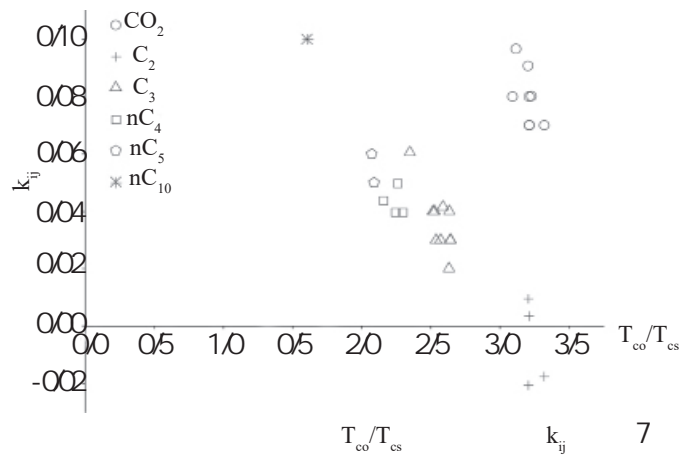
: (299°C) [40] : k_ij 4



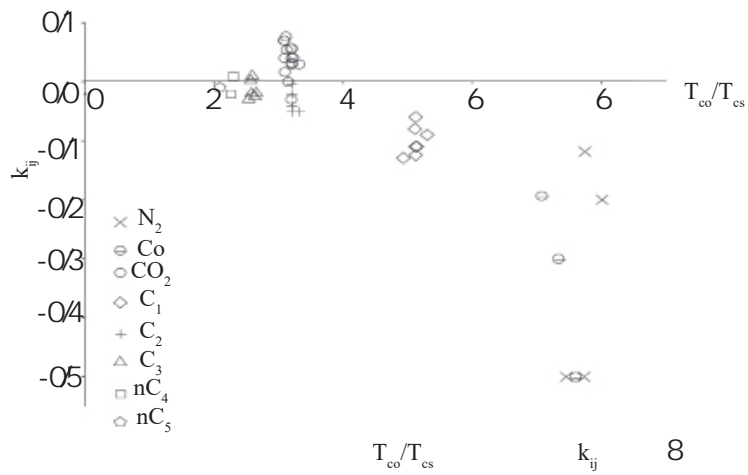
: (35°C)]35[: k_{ij} 5



: (125°C)]36[: k_{ij} 6



T_{co}/T_{cs} k_{ij} 7



()

k_{ij}

k_{ij} 8 7

k_{ij}

8 7

k_{ij} T_{co}/T_{cs}

k_{ij}

]71[

]71[

k_{ij}

k_{ij}

2

k_{ij} T_{co}/T_{cs}

T_{co}/T_{cs}

k_{ij}

k_{ij}

Tco/Tcs		k_{ij}	2
k_{ij}			Tco/Tcs
0/100	0/100		1/5-2
0/060	0/050		2-2/5
0/050	0/040		
0/061	0/020		2/5-3
0/010	-0/020		3-3/5
0/152	0/070		
-0/010	-0/010		2-4
0/010	-0/020		
0/010	-0/030		
-0/030	-0/050		
0/076	0/000		
-0/009	-0/200		4-6
0/119	-0/500		6-8
-0/193	-0/500		

()

k_{ij}

$$k_{ij} = -0.0567 \frac{T_{CO}}{T_{CS}} + 0.1773 \quad (15)$$

k_{ij}

k_{ij}

13

$$k_{ij} = -0.0332 \frac{T_{CO}}{T_{CS}} + 0.0709 \quad (16)$$

11

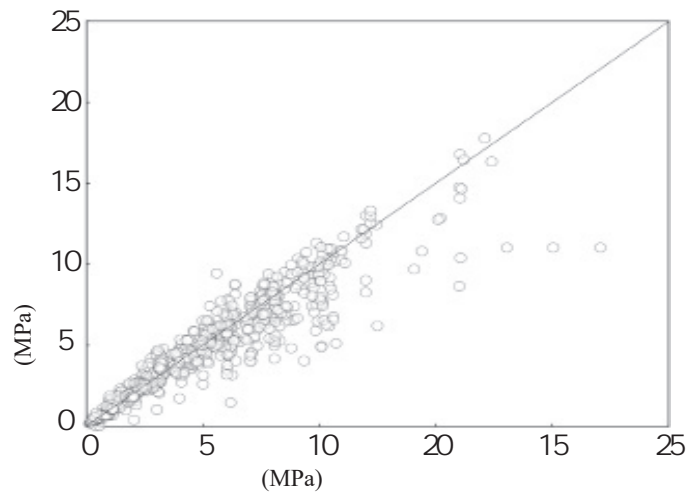
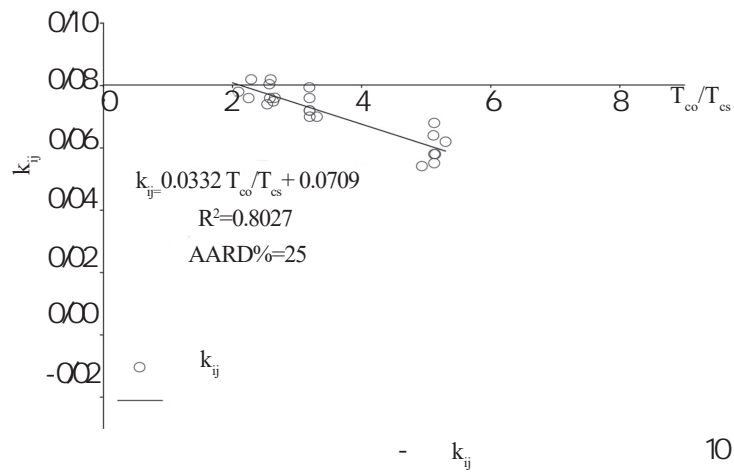
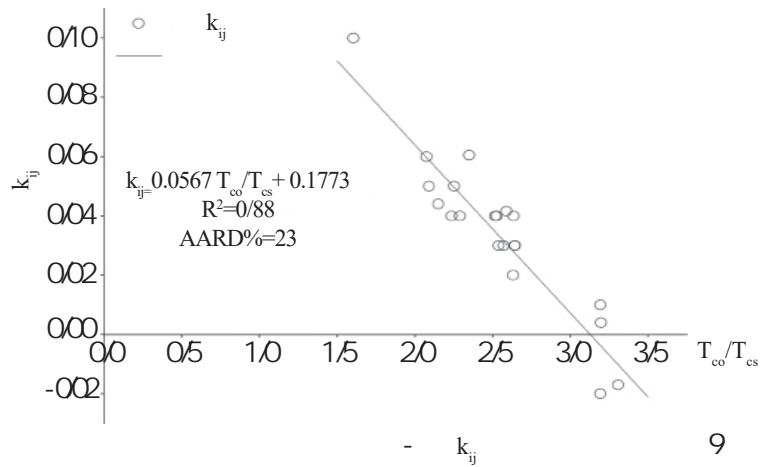
10 9

25

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24

k_{ij}





k_{ij}

نتیجه گیری

1000

APR

k_{ij}

:

[72]

-1

$L_1 L_2$

-2

$L_1 L_2 V$

L_2

-3

APR

-4

T_{co}/T_{cs}

k_{ij}

-5

k_{ij}

2

k_{ij}

-9

-6

-10

 k_{ij}

-7

-11

-8

 k_{ij}

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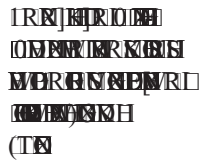
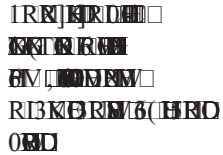
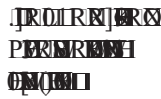
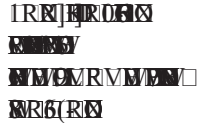
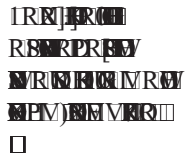

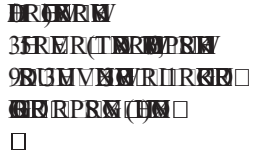
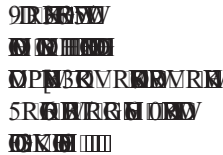



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