



Modelling of ECBM and CO₂ storage in coal reservoir: An Iterative study

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INTRODUCTION

- ❑ CO₂ sequestration in coalbed enhances the production of methane from coalbed and termed as Enhanced Coalbed Methane (ECBM)
- ❑ Understanding of adsorption characteristics of known gas mixture gives the necessary input for the accurate assessment of the ECBM process modeling
- ❑ In this paper a coal reservoir Jharia coalfield was modelled using Multicomponent Iterative Adsorption (MIA) model
- ❑ MIA model was utilized with variable gas composition of CO₂ and at constant pressure of 2000 psi
- ❑ Pure gas isotherm data for CO₂ and CH₄ was utilized for the implication of MIA model

METHODOLOGY

- ❑ First samples were characterized on the basis of proximate, ultimate and petrographic analysis
- ❑ Pure gas isotherms were drawn and P_L and V_L values were calculated as given in table 2
- ❑ Binary mixtures of CH₄ and CO₂ were taken to model the coal reservoir at pressure of 2000 psi
- ❑ MIA was proposed using iteration method to study the co adsorption isotherm of CH₄ and CO₂ at different binary mixtures
- ❑ MIA model requires only pure gas adsorption data i.e. adsorption isotherm data of CH₄ and CO₂

DEVELOPMENT OF MIA MODEL

- ❑ One objective function has been formulated, which can be defined as follows

$$F(\phi^*) = \sum_{i=1}^{n_c} \frac{Py_i}{P_i^o(\phi^*)} - 1 = 0$$

- ❑ Where ϕ^* is the spreading pressure, y_i the mole fraction of the component in gas phase and $P_i^o(\phi^*)$ is the pure adsorbate pressure

- ❑ Now ϕ^* has been solved by iteration method:

$$\phi^{*(n+1)} = \phi^{*(n)} - \frac{F(\phi^{*(n)})}{F'(\phi^{*(n)})}; n \text{ is the iteration number}$$

RESULTS AND DISCUSSIONS

Table 1. Sample Characterization

Proximate Analysis (wt%, ad)							
Sample	M	A	VM	FC	V ^{daf}	FC ^{daf}	
JJ/01	1.15	30.21	14.08	54.56	20.51	79.49	
JJ/02	0.78	30.41	18.85	49.96	27.39	72.61	
Ultimate Analysis (wt%,)							
Sample	C	H	N	S	O		
JJ/01	76.99	3.33	2.54	0.51	29.39		
JJ/02	63.32	3.41	1.78	0.55	42.42		
Petrographic Analysis							
Sample	Virinite (%)	Intertinite (%)	Liptinite (%)	Clay (%)	Pyrite (%)	Mineral Matter (%)	Vitrinite Refl. (R ₀ %)
JJ/01	51.282	37.607	3.846	5.983	1.282	7.265	1.98
JJ/02	40.339	52.203	1.356	6.102	traces	6.102	1.63

Table 2. Pure gas isotherm data

Sample	V _L (scf/ton)		P _L (psi)	
	CH ₄	CO ₂	CH ₄	CO ₂
JJ/01	500	1000	214	651.1
JJ/02	476.19	833.33	331.23	124.75

RESULTS AND DISCUSSIONS

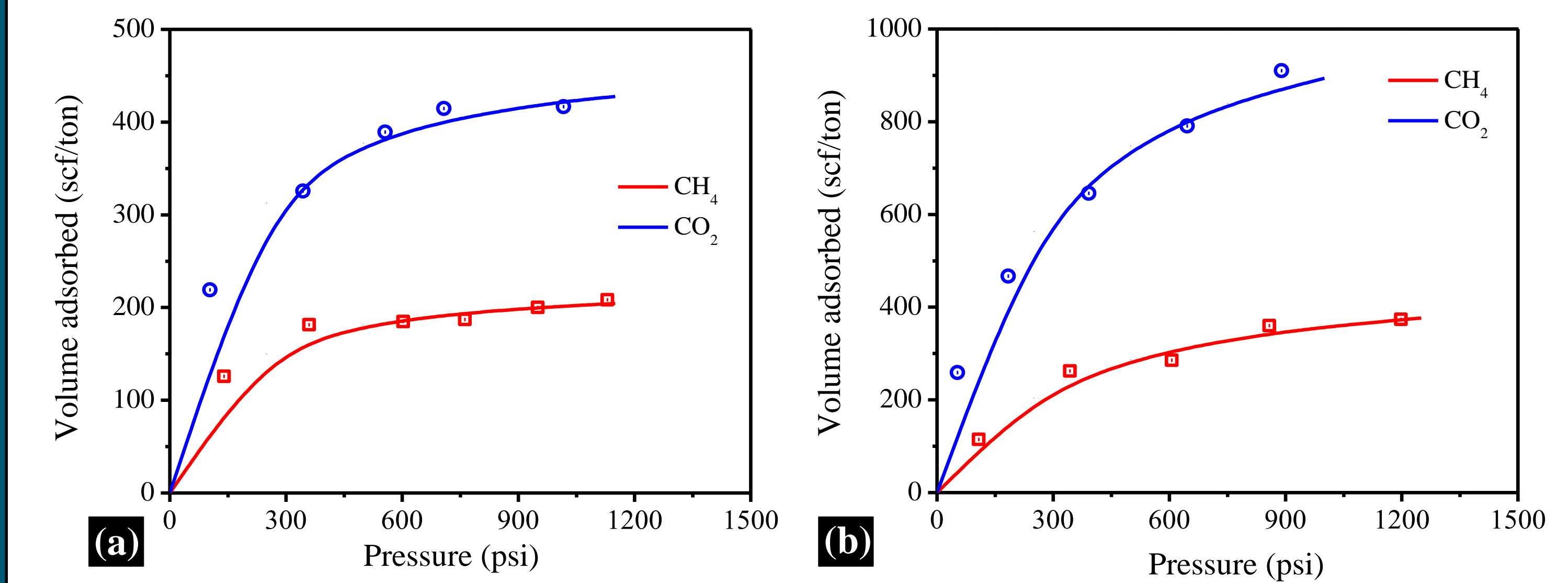


Figure 1. Pure gas isotherm (a) JJ/01 (b) JJ/02

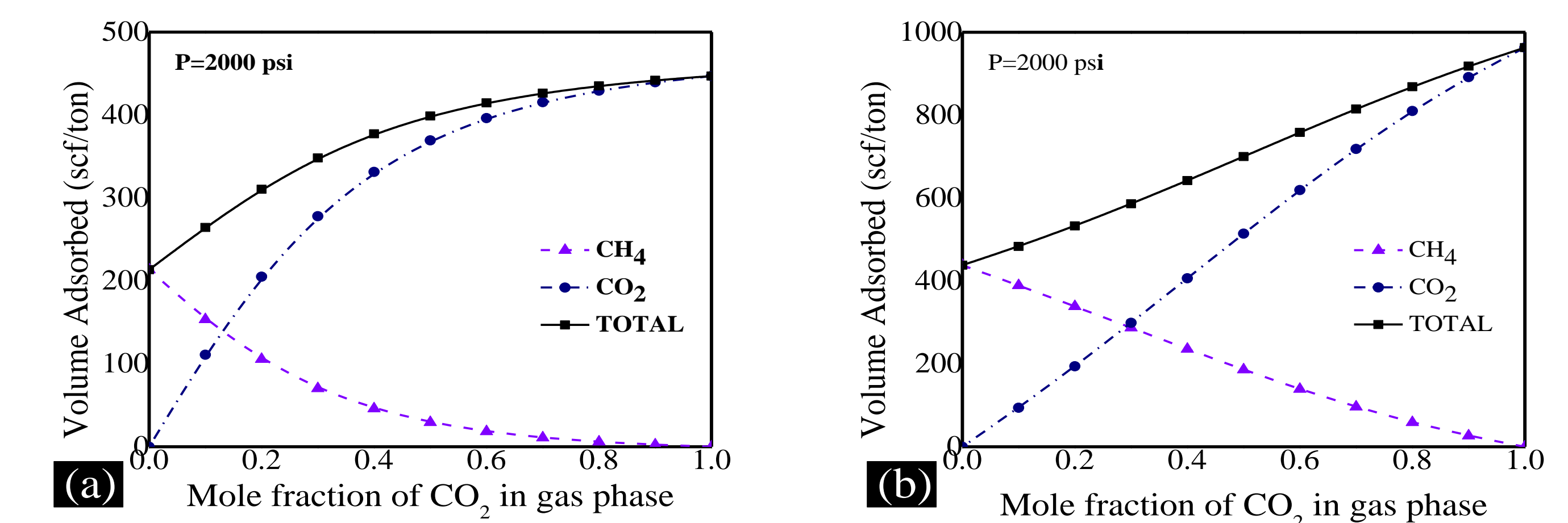


Figure 2. Co adsorption isotherm (a) JJ/01 (b) JJ/02

CONCLUSION

- ❑ MIA model was successfully implemented for modelling the coal reservoir of Jharia Coalfield
- ❑ MIA model predicts that ECBM recovery for sample JJ/01 will occur after 13.03 % of CO₂ in gas phase
- ❑ For sample JJ/02 ECBM recovery will occur after 27.4% of CO₂ in gas phase
- ❑ MIA model predicts that separation of CH₄ is a function of CH₄ and CO₂ mole fraction in gas and adsorbed phase

REFERENCES

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