

Pillared amino-modified magadiite: The effect on CO₂ adsorption capacity

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Abstract: CTA-magadiite pillarization results in a porous material whose structure and morphology are dependent on the reaction media and are also reflected on CO₂ adsorption capacity.

Key words: Magadiite, pillarization, adsorption.

Introduction

The pillarization process (PC) in the crystalline structure of magadiite (phyllosilicate) builds a continuous network of pores with controlled pore size and distribution. The subsequent functionalization and insertion of the pending amino group (APTS) on pillared CTA-magadiite creates sites capable of adsorbing CO₂ at room temperature.

The objective of this paper is to investigate the best pillaring procedure, acidic or alkaline, which produce a large surface area solid with increased gas adsorption capacity.

Results and Discussion

The studies of pillarization procedure at acid (PC-CTA-magadiite (A)) and alkaline media (PC-CTA-magadiite(B)) in direct synthesis CTA-magadiite was made to observe variations in structure and morphological characteristics of the obtained materials. The type of hydrolysis of the pillaring agent (TEOS) reflects on the materials characteristics and its BET area, as seen in Table 1.

The changes in porous properties with the pillaring reaction (APT-CTA-magadiite (B) and (A)), indicates that the addition of APTS during pillarization caused the decrease in pore sizes. (Figure 1)

Table 1. BET^a and DFT[#] analysis of porous materials.

Sample	S _{BET} ^a / m ² g ⁻¹	D _p ^{#b} / nm	V _p ^{#c} / cm ³ g ⁻¹	C _a ^d / mmol g ⁻¹
PC-CTA-magadita (B)	602	4.89	1.1	-
PC-CTA-magadita (A)	673	1.06	0.40	-
APT-CTA-magadiita (A)	114	55.9	0.75	1.78
APT-CTA-magadiita (B)	121	16.7	0.71	3.87

^a.surface area; ^b. pore diameter; ^c. pore volume; ^d. adsorption capacity

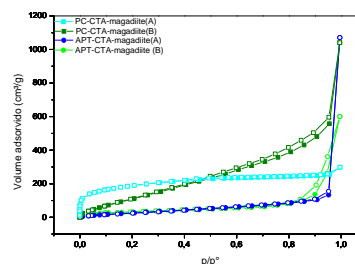


Figure 1: N₂ adsorption/desorption isotherms.

The termoprogrammed desorption studies (TPD) on Figure 2, show large difference on gas adsorption capacity. The APT-CTA-magadiite (B) is approximately 217 % more capable of CO₂ adsorption than APT-CTA-magadiite (A).

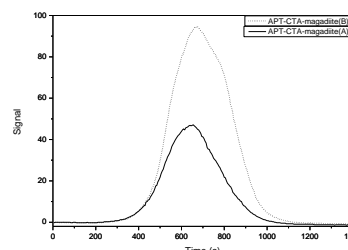


Figure 2: CO₂ desorption study (TPD) at 50°C.

Conclusions

Both APTS-modified and pillared CTA-magadiite adsorb CO₂; the hydrolysis procedure controls the CO₂ adsorption capacity. In spite of their different characteristics, the APT-CTA-magadiite (B) is the most effective for the purpose of the present study.

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¹ H. O. Pastore, M. Munsignatti, A.J. S. Mascarenhas, *Clays and Clay Minerals*. **2000**, 48, 224-229.

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