Supplementary

**Table Ⅰ** CO2 capacity of magnesite slag under different conditions ( 10% CO2 )

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *Calcination temperature*, oC | *Calcination time*, h | *Adsorption temperature*, oC | *Flow rate*, mL/min | *Adsorption pressure*, Mpa | *CO2 adsorption capacity*, mmol/g  |
| 500 | 5 | 60 | 100 | 0.1 | 1.16 |
| 550 | 5 | 60 | 100 | 0.1 | 1.04 |
| 600 | 5 | 60 | 100 | 0.1 | 0.97 |
| 650 | 5 | 60 | 100 | 0.1 | 0.62 |
| 500 | 3 | 60 | 100 | 0.1 |  0.84 |
| 500 | 4 | 60 | 100 | 0.1 | 0.89  |
| 500 | 6 | 60 | 100 | 0.1 | 1.13 |
| 500 | 5 | 40 | 100 | 0.1 | 0.88  |
| 500 | 5 | 80 | 100 | 0.1 | 1.43 |
| 500 | 5 | 100 | 100 | 0.1 | 1.07 |
| 500 | 5 | 80 | 150 | 0.1 | 1.11 |
| 500 | 5 | 80 | 200 | 0.1 | 1.08 |
| 500 | 5 | 80 | 150 | 0.4 | 2.12 |
| 500 | 5 | 80 | 150 | 0.8 | 3.01 |

**Table SⅠ** Different MgO-based adsorbents performance

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Adsorbents | *Calcination tempterature*, oC | *Calcination time*, h | *Regeneration temperature*, oC  | *Adsorption temperature*, oC | *Adsorption* *Capacity*, mmol/g |
| MgO/Al2O327 | 600 | 5 | 120 | 25 | 0.73 |
| MgO ( solvothermal) 28 | 450 | 6.7 | - | - | - |
| MgO/OMC29 | 900 | 6 | 200 | 25 | 2.04 |
| MgO/ CMK-330 | 800 | 8.8 | 800 | 25 | 1.81 |
| MgO(solvothermal) 31 | 550 | 22 | 160-840 | 90 | 0.36 |
| Foam magnesia32 | 600 | 12 | 30-600 | 100 | 2.61 |
| MgO/Al-SBA33 | 450 | 7.8 | 100 | 25 | 1.36 |
| MgO34 | 400 | 8.6 | - | 50 | 0.81 |
| MgO/k-SBA35 | 540 | 17 | 300 | 20 | 0.91 |
| MgO36 | 400 | 5.3 | - | 50 | 1.59 |
| MG-480-42-13.837 | 480 | 0.7 | - | 60 | 0.77 |
| MgO/BM2.5h38 | 323 | 0.5 | 850 | 25 | 1.61 |
| MgO/Al2O3-0.239 | 400 | 1 | 450 | 60 | 2.1 |
| Calcinated magnestie22 | 550 | 4 | 550 | 60 | 1.82 |
| Calcinated magnesite slag (This work) | 500 | 5 | 550 | 80 | 3.01 |

**Table SⅡ** The XRF results of calcined magnesite slag at 500 oC for 5 h

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ElementContent/%  | Mg | Si | Mn | Ca | Fe | Al |
|  | 32.18 | 11.09 | 3.18 | 1.51 | 1.19 | 3.82 |

**Table Ⅱ** Porous structure parameters achieved by N2 adsorption-desorption isotherm

|  |  |  |  |
| --- | --- | --- | --- |
| Sample | *BET* surface area, m2/g | Pore volume, cm3/g | Pore size, Å |
| calcined magnesite slag ( 500 oC ) | 51.26 | 0.08 | 26.39 |
| calcined magnesite slag ( 600 oC ) | 28.03 | 0.04 | 27.30 |
| After 4 cycles | 26.86 | 0.05 | 29.85 |
| After 8 cycles | 29.43 | 0.04 | 27.42 |



**Figure 1** CO2 adsorption experiment chart



**Figure 2** TG-DSC curve of the magnesite slag



(a)



(b)



(c)



(d)



(e)



(f)



(g)



(h)

**Figure S1** N2 adsorption-desorption isotherms (a, c, e, g) and pore size distributions (b, d, f, h) of magnesite slag calcined at 500 oC for 5 h, 600 oC for 5 h, after 4 cycles and after 8 cycles (*P / P0*: relative pressure; *STP*: standard temperature and pressure)