Supplementary

**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/Al2O325 | 600 | 5 | 120 | 25 | 0.73 |
| MgO ( solvothermal) 26 | 450 | 6.7 | - | - | - |
| MgO/OMC27 | 900 | 6 | 200 | 25 | 2.04 |
| MgO/ CMK-328 | 800 | 8.8 | 800 | 25 | 1.81 |
| MgO(solvothermal) 29 | 550 | 22 | 160-840 | 90 | 0.36 |
| Foam magnesia30 | 600 | 12 | 30-600 | 100 | 2.61 |
| MgO/Al-SBA31 | 450 | 7.8 | 100 | 25 | 1.36 |
| MgO32 | 400 | 8.6 | - | 50 | 0.81 |
| MgO/k-SBA33 | 540 | 17 | 300 | 20 | 0.91 |
| MgO34 | 400 | 5.3 | - | 50 | 1.59 |
| MG-480-42-13.835 | 480 | 0.7 | - | 60 | 0.77 |
| MgO/BM2.5h36 | 323 | 0.5 | 850 | 25 | 1.61 |
| MgO/Al2O3-0.237 | 400 | 1 | 450 | 60 | 2.1 |
| Calcinated magnestie20 | 550 | 4 | 550 | 60 | 1.82 |
| Calcinated magnesite slag (This work) | 500 | 5 | 550 | 80 | 3.01 |

**Table SⅡ** The conditions and results comparison of calcined magnesite slag with magnesite

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| *Sample* | *Calcination temperature*, oC | *Calcination time*, h | *Adsorption temperature*, oC | *Flow rate*, mL/min | *Adsorption pressure*, Mpa | *CO2 adsorption capacity*, mmol/g |
| Magnesite20 | 550 | 4 | 60 | 100 | 0.4 | 1.82 |
| Magnesite slag | 500 | 5 | 80 | 150 | 0.4 | 2.12 |
|  | 500 | 5 | 80 | 150 | 0.8 | 3.01 |

**Table SⅡI** The XRF results of calcined magnesite slag and magnesite

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Element  Content/% | Mg | Si | Mn | Ca | Fe | Al |
| Magnesite slag | 32.18 | 11.09 | 3.18 | 1.51 | 1.19 | 3.82 |
| Magnesite | 53.59 | 0.22 | 5.87 | 0.8 | 0.79 | - |



(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)