Electronic Supplementary Material (ESI) for RSC Advances.


# Electronic Supplementary Information

## Calcination Temperature-Dependent Surface Structure and Physicochemical Properties of Magnesium Oxide

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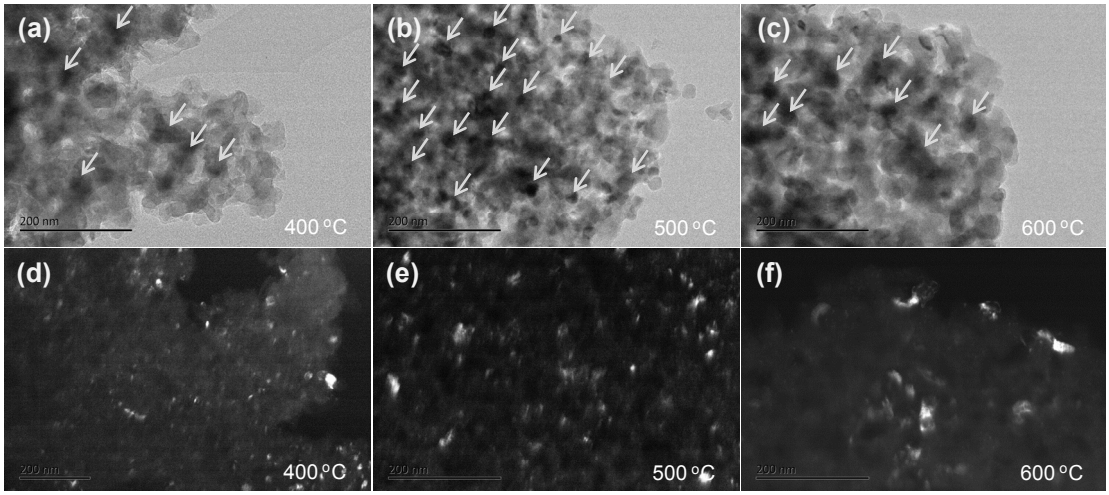


**Fig. S1** HRTEM images of the calcined MgO at the temperatures of (a) 400 $^{o}$C, (b) 500 $^{o}$C, and (c) 600 $^{o}$C; and HRTEM dark-field images of the obtained MgO at (d) 400 $^{o}$C, (e) 500 $^{o}$C, and (f) 600 $^{o}$C. *Note*: The white arrows in (a), (b) and (c) indicate the single crystals among the calcined MgO. From the dark-field images in (d), (e) and (f), it can be seen that with the increase in the calcination temperature, the size of the crystallites steadily increased.

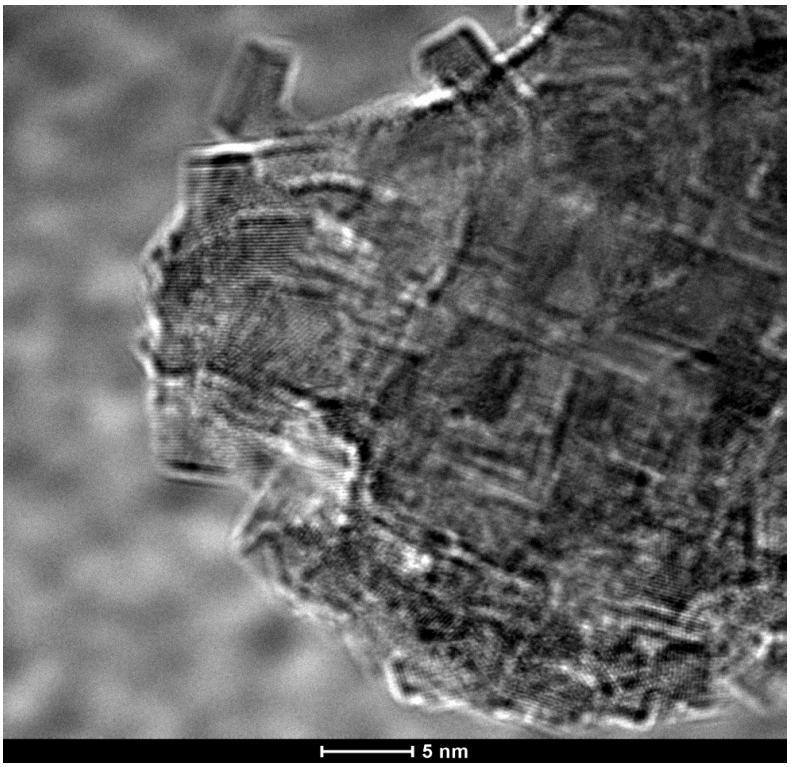


**Fig. S2** HRTEM image of the calcined MgO at the temperature of 700 $^{o}$C.

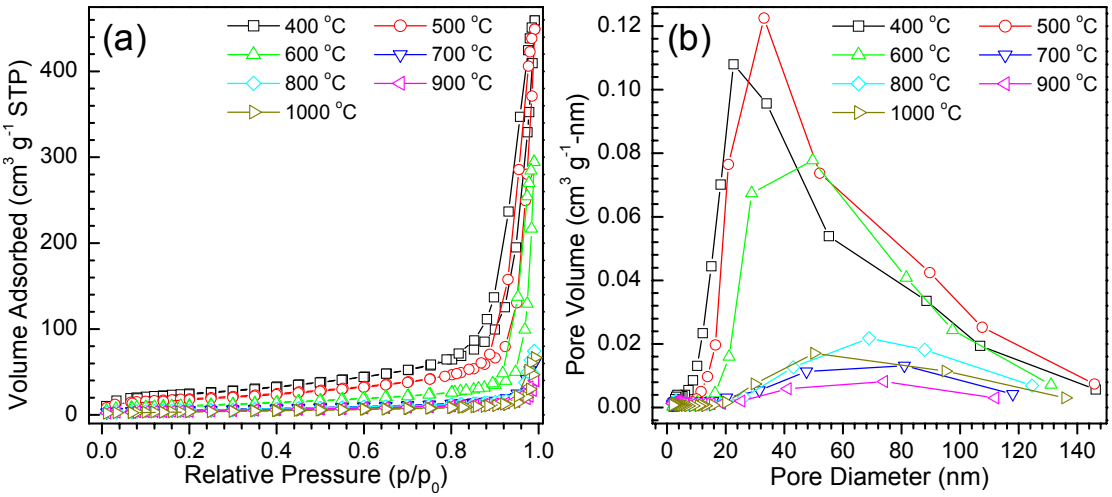


**Fig. S3** (a) $N_2$ adsorption-desorption isotherms and (b) BJH pore size distribution curves of the calcined MgO samples at different temperatures ranging from 400 $^{o}$C to 1000 $^{o}$C.

**Table S1.** Effect of calcination temperature on the catalytic performance of different catalysts in the literature

| Entry | Catalyst | Calcination Temperature ($^{o}$C) | Conversion Efficiency (%) | Reference |
|---|---|---|---|---|
| 1 | MgO | 450 | 50.6 | [1] |
| | | 600 | 38.0 | |
| | | 750 | 28.3 | |
| 2 | $Mg_5(CO_3)_4(OH)_2{\cdot}4H_2O$ | 80 | 78.0 | [2] |
| | | 200 | 63.0 | |
| | | 300 | 32.0 | |
| | | 400 | 31.0 | |
| 3 | $Mg_5(CO_3)_4(OH)_2{\cdot}4H_2O$ | 450 | 85.0 | [3] |
| | | 475 | 75.0 | |
| | | 500 | 28.0 | |
| | | 600 | 5.0 | |
| | | 800 | 0.5 | |
| 4 | Slag-Based Catalyst | 350 | 51.4 | [4] |
| | | 450 | 44.5 | |
| | | 550 | 24.8 | |
| | | 650 | 24.7 | |
| 5 | Ni/MgO | 550 | 73.0 | [5] |
| | | 600 | 89.1 | |
| | | 700 | 73.0 | |
| | | 800 | 15.7 | |
| 6 | $TiO_2$ | 350 | 59.0 | [6] |
| | | 400 | 91.0 | |
| | | 500 | 75.0 | |
| | | 600 | 70.0 | |
| 7 | 2% Mo/HZSM-5 | 500 | 8.6 | [7] |
| | | 700 | 7.7 | |
| | | 750 | 5.1 | |
| | | 800 | 3.9 | |
| | | 850 | 2.4 | |
| | | 900 | 1.1 | |
| 8 | 25% $WO_3/SnO_2$ | 350 | 88.6 | [8] |
| | | 550 | 83.8 | |
| | | 650 | 50.3 | |
| | | 750 | 11.1 | |
| | | 850 | 7.5 | |
| 9 | $CrO_x$-$Y_2O_3$ | 400 | 23.0 | [9] |
| | | 500 | 17.5 | |
| | | 600 | 8.0 | |
| | | 800 | 2.5 | |

**Table S2.** Texture properties of as-synthesized MgO calcined at different temperatures

| Temperature ($^{o}$C) [a] | BET surface area ($m^2 \cdot g^{-1}$) [b] | Pore Volume ($cm^3/g$ ) | Average Pore Diameter (nm) |
|---|---|---|---|
| 400 | 88.8 | 0.71 | 23.8 |
| 500 | 66.9 | 0.69 | 30.5 |
| 600 | 39.7 | 0.46 | 34.8 |
| 700 | 20.3 | 0.09 | 17.2 |
| 800 | 19.3 | 0.11 | 22.5 |
| 900 | 17.0 | 0.06 | 14.4 |
| 1000 | 13.6 | 0.10 | 27.2 |

Note: [a] Using the standard Brunauer–Emmett–Teller (BET) method; [b] Using the Barret–Joyner–Halenda (BJH) method.

## Notes and references


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