遼寧科技大學
University of Science and Technology Liaoning

Research of Lightweight Periclase-Hercynite Bricks for Cement Kiln

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CONTENT

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1. Introduction

(1) At present, the main raw materials of periclase-hercynite brick for cement kiln burning zone are sintered magnesia and hercynite. The thermal conductivity is about 3.0 W/m·K, and the temperature of cement kiln shell is about 350 ~ 400 °C.

(2) If the thermal conductivity of the brick decreases, the heat loss will decrease, and the temperature of the cement kiln shell will decrease, so as to achieve the effect of protecting the equipment and saving energy.

2.1

Lightweight magnesia aggregates

Effect of SDBS content on lightweight magnesia aggregates
- aqueous foam
- foam slurry
- aggregates

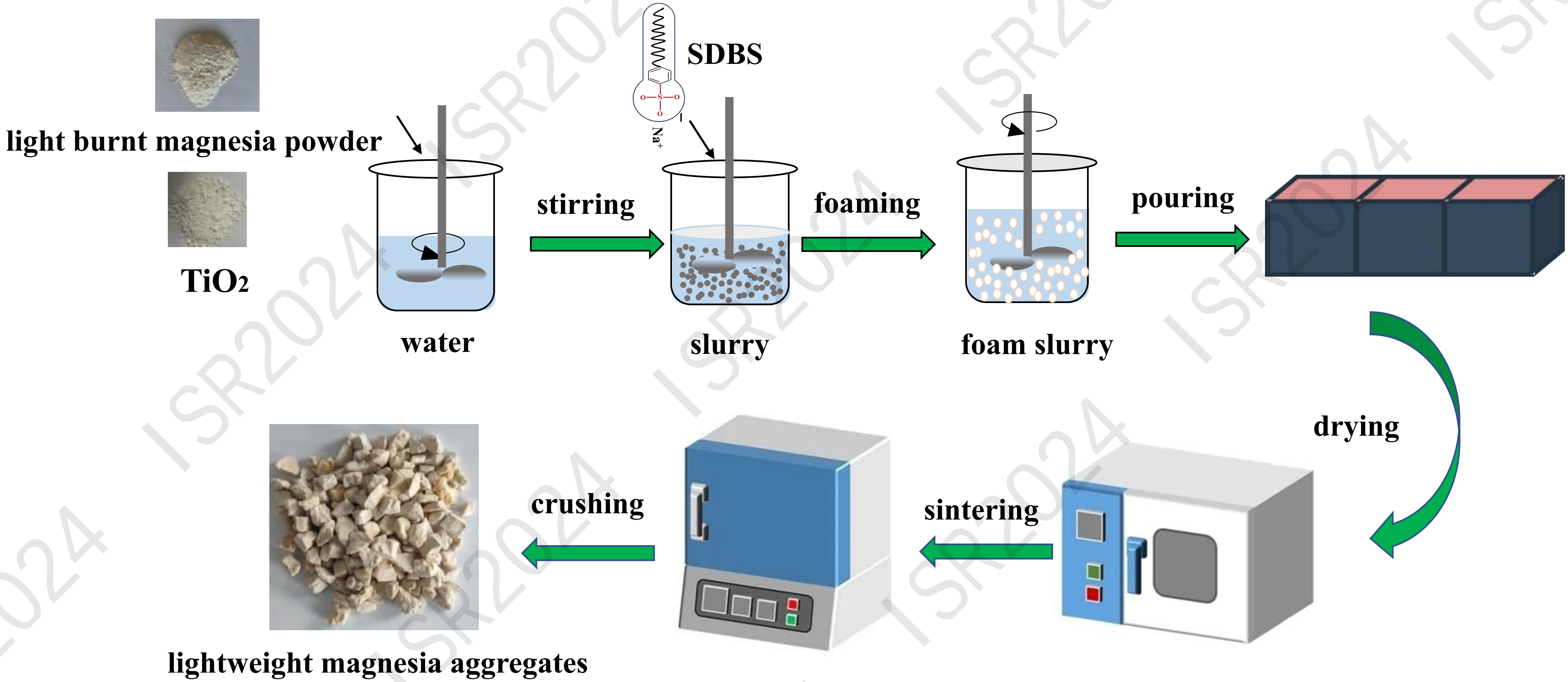
Effect of TiO_2 content on lightweight magnesia aggregates
- foam slurry
- aggregates

2.2

Lightweight periclase-hercynite bricks

Effect of lightweight magnesia aggregatse content on bricks

2.1.1 Lightweight magnesia aggregates preparation



2.1.2 Effect of SDBS on microstructure of aqueous foam

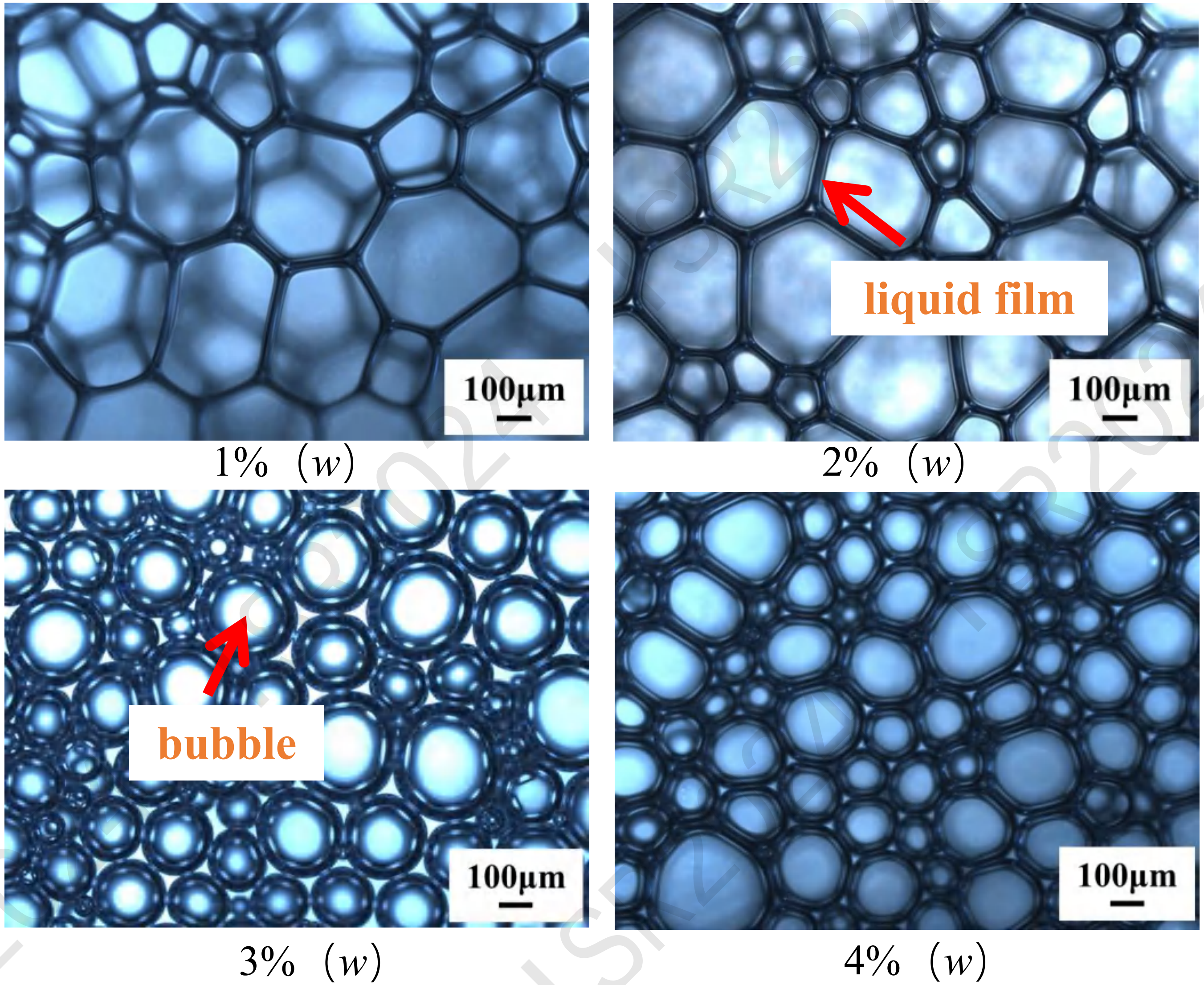
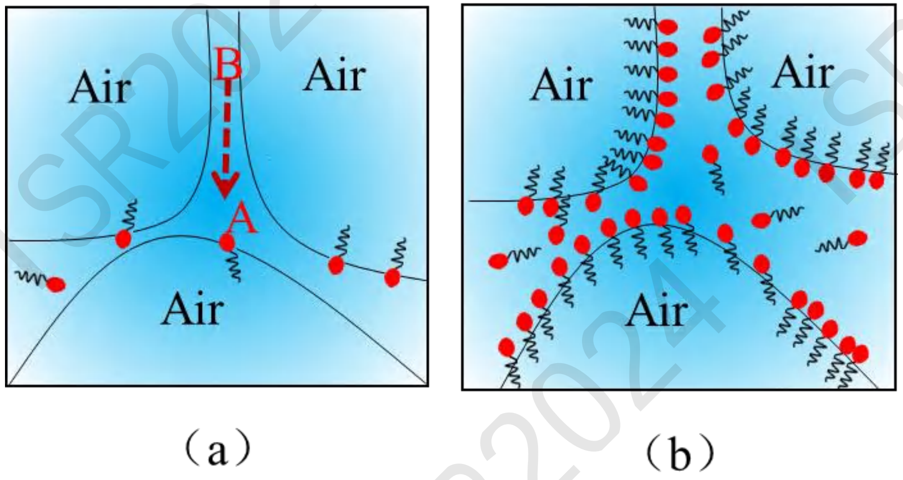


Fig.1 Effect of SDBS on microstructure of aqueous foam



In aqueous foam, with the increase of SDBS content, the number of bubbles increases, the foam shape changed from polygon to circle, the liquid film of foam became thicker.

2.1.3 Effect of SDBS on microstructure of magnesia foam slurry

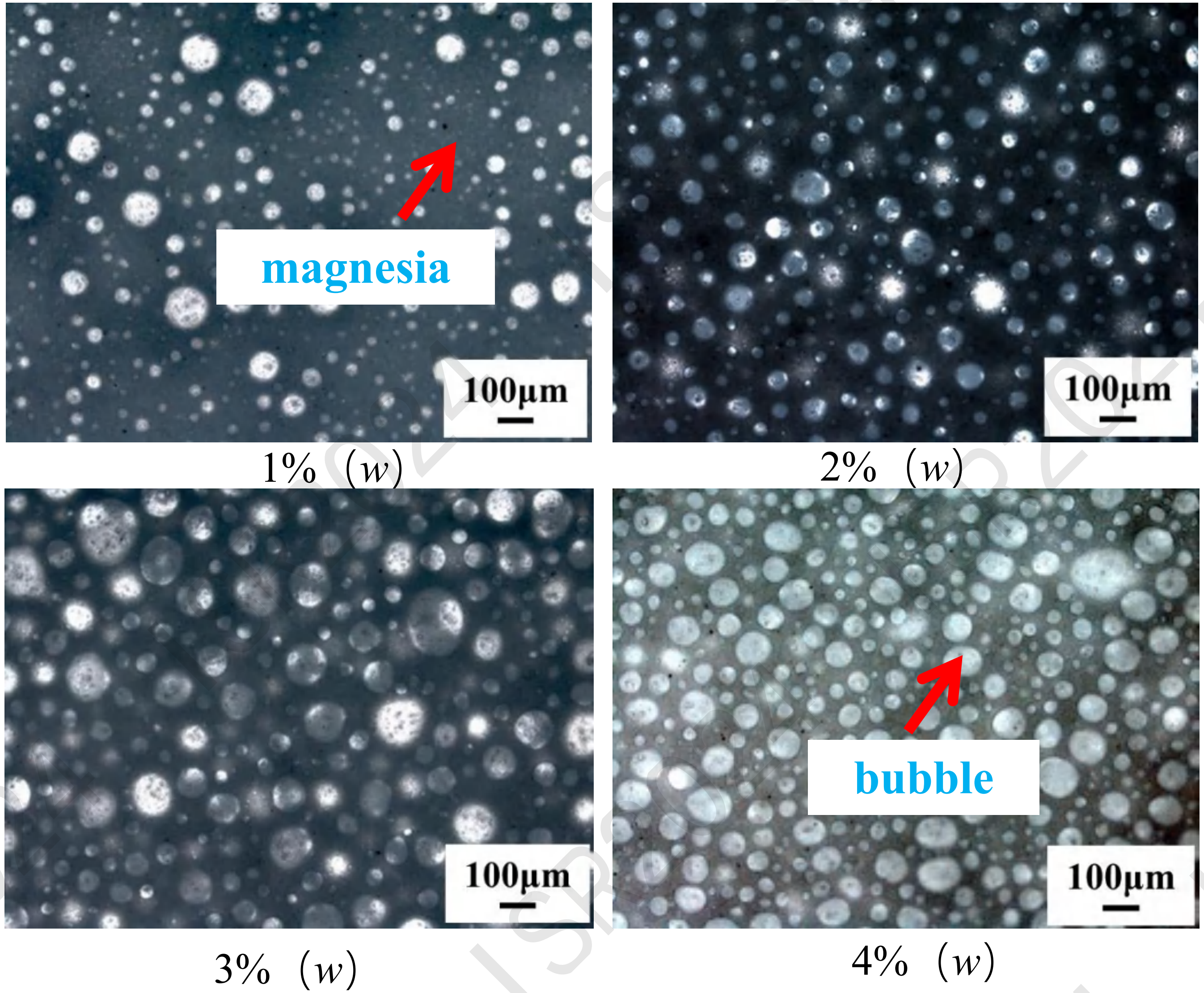
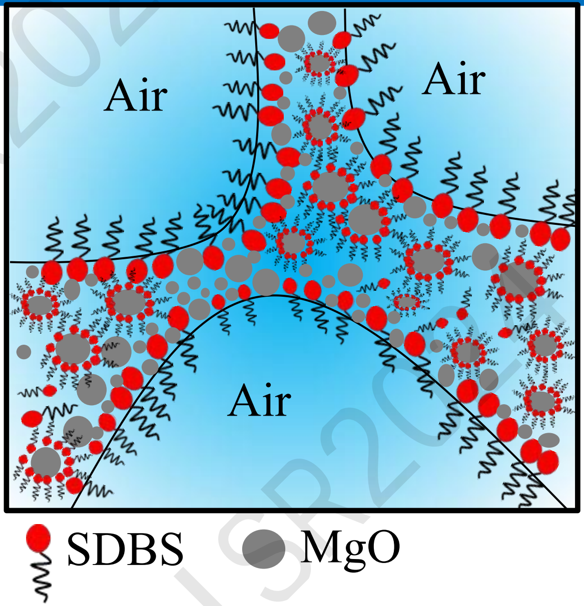


Fig.2 Effect of SDBS on microstructure of magnesia foam slurry



Compared with aqueous foam, the bubble size decreases and the number of bubbles increases in magnesia foam slurry.

Magnesia improves the stability of foam slurry.

2.1.4 Effect of SDBS on magnesia aggregates

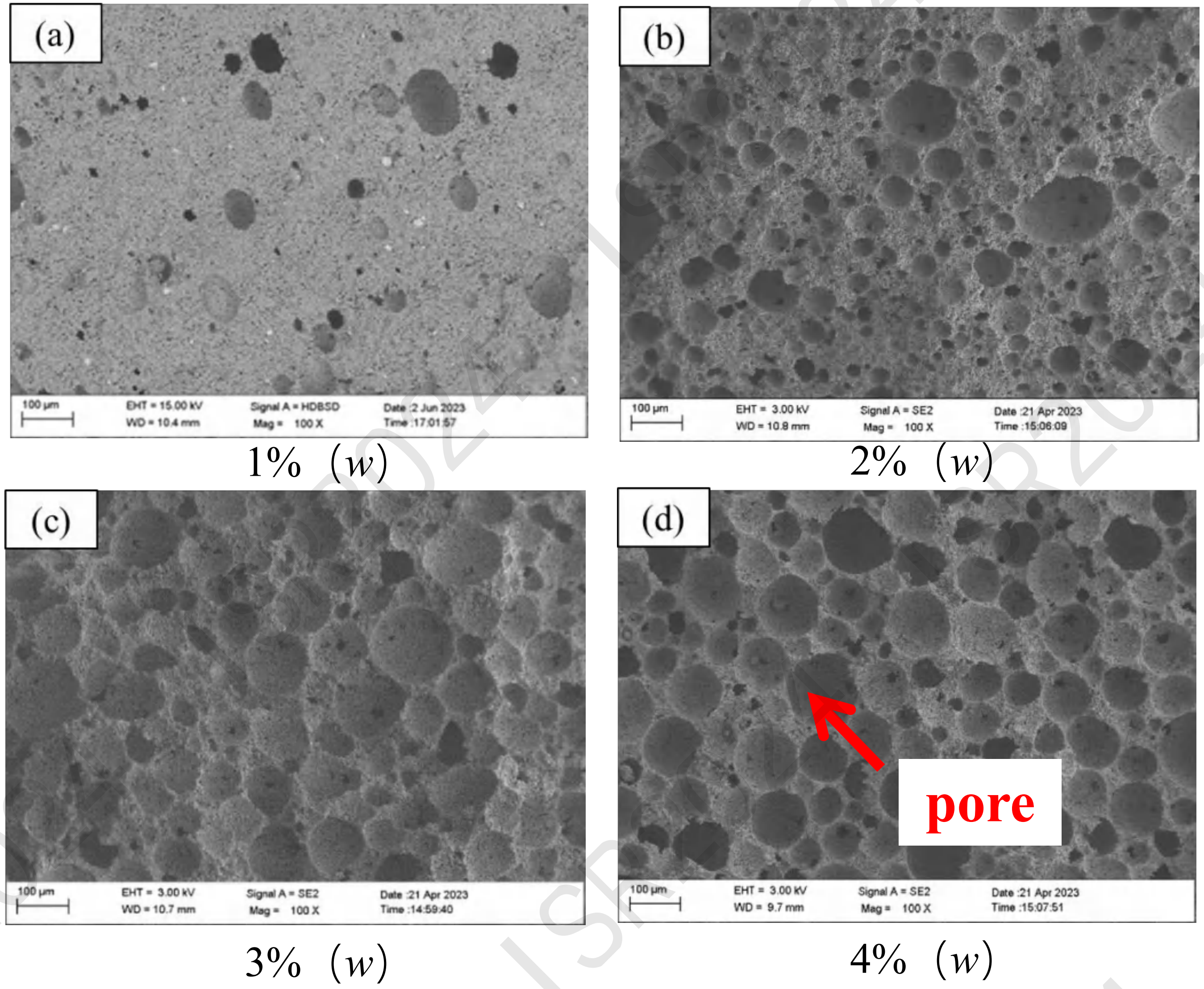


Fig.3 Effect of SDBS on magnesia aggregates

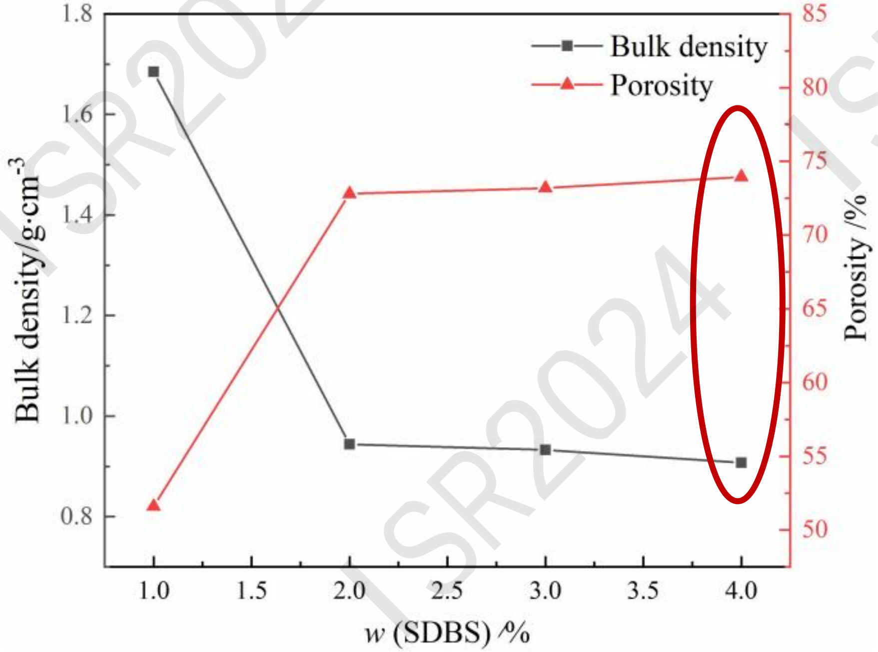


Fig.4 bulk density and porosity

It can be seen that the size and shape of the pores are the best when SDBS content is 4% (*w*).

2.1.5 Effect of TiO_2 on magnesia foam slurry

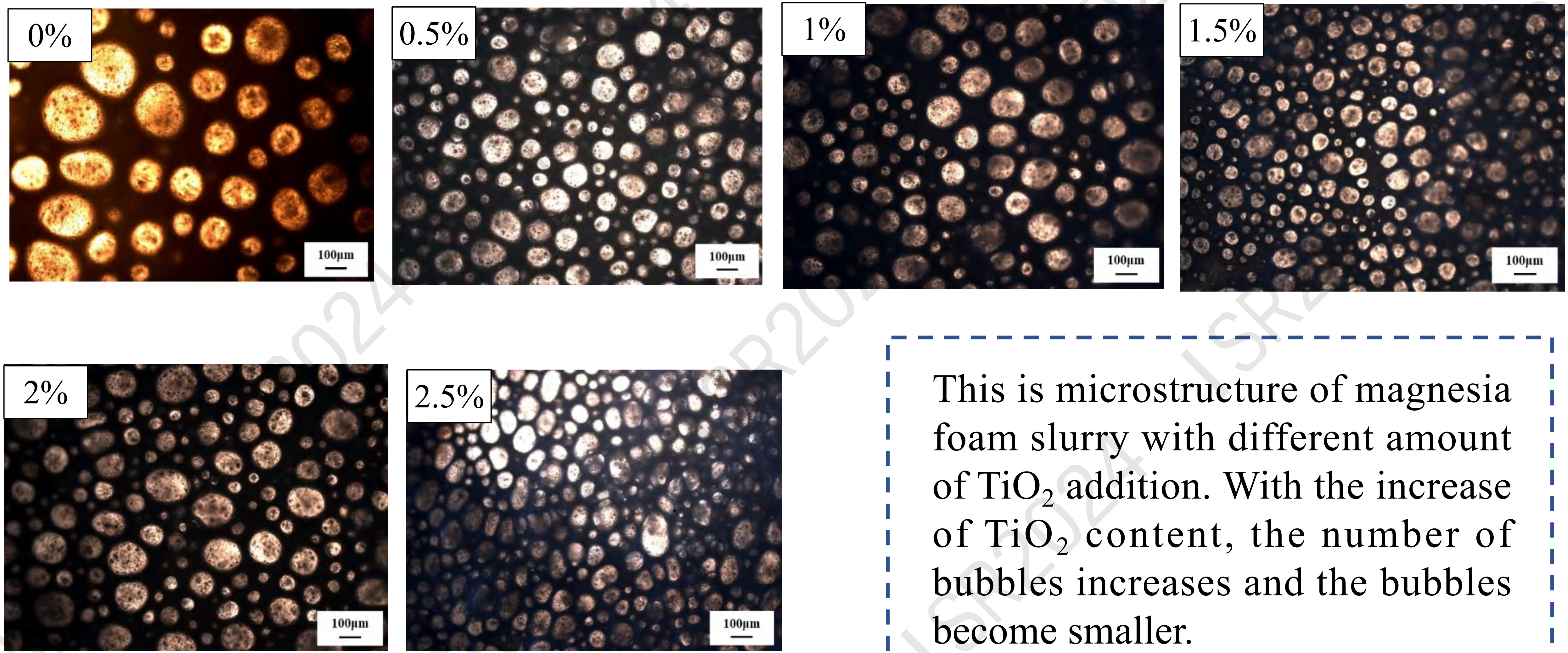
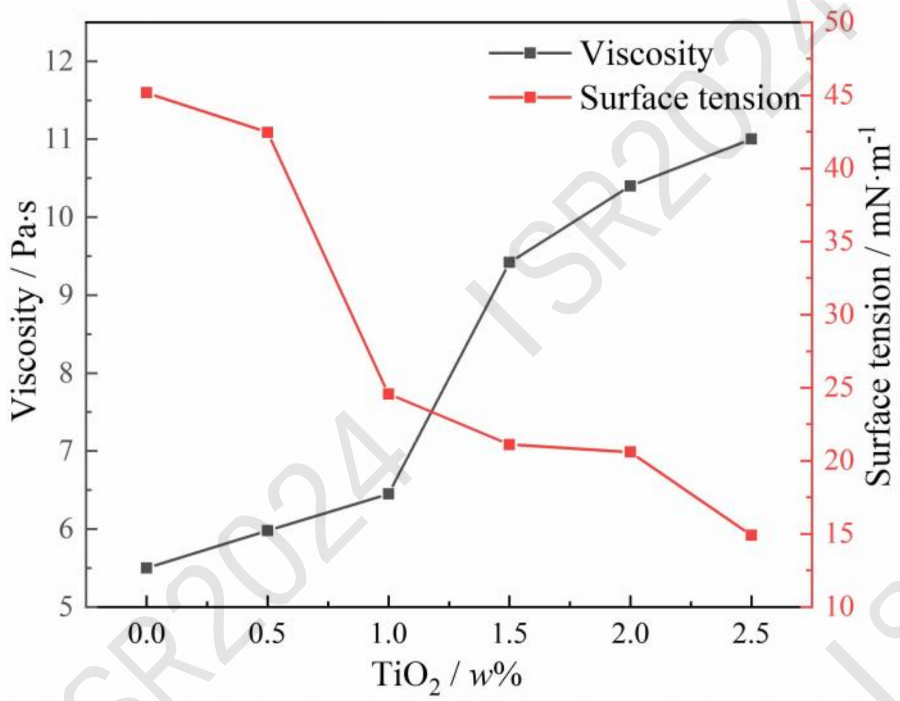
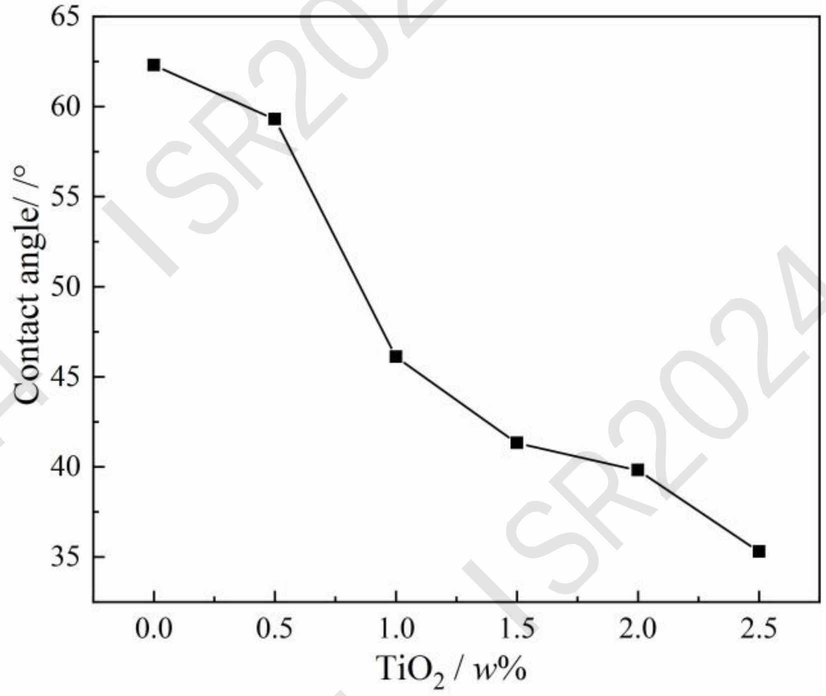


Fig.5 Effect of TiO_2 on microstructure of magnesia foam slurry

This is microstructure of magnesia foam slurry with different amount of TiO_2 addition. With the increase of TiO_2 content, the number of bubbles increases and the bubbles become smaller.



(a) surface tension and viscosity



(b) contact angle

Fig.6 Effect of TiO_2 on magnesia foam slurry

With the increase of TiO_2 addition, the surface tension of magnesia foam slurry decreases, the viscosity of magnesia foam slurry increases, and the contact angle magnesia foam slurry decreases.

2.1.6 Effect of TiO_2 of lightweight magnesia aggregates

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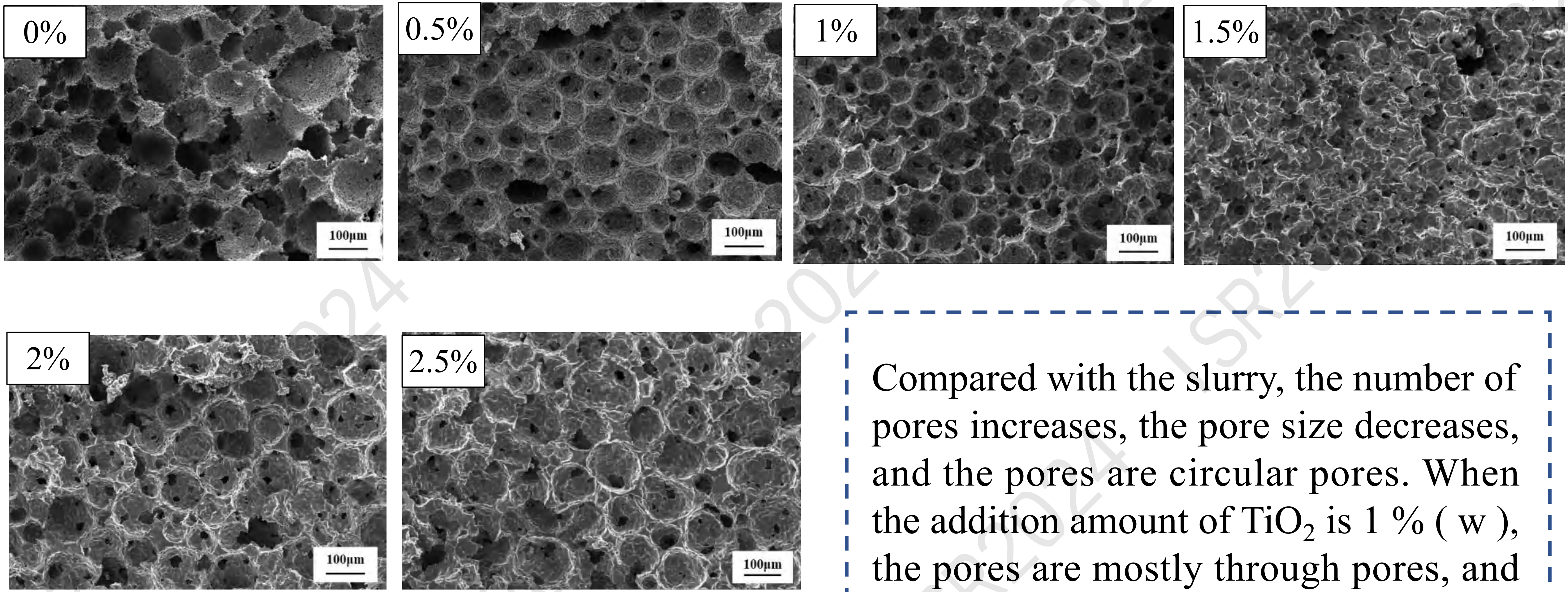


Fig.7 Effect of TiO_2 on microstructure of lightweight magnesia aggregates

Compared with the slurry, the number of pores increases, the pore size decreases, and the pores are circular pores. When the addition amount of TiO_2 is 1 % (w), the pores are mostly through pores, and the pore is incomplete.

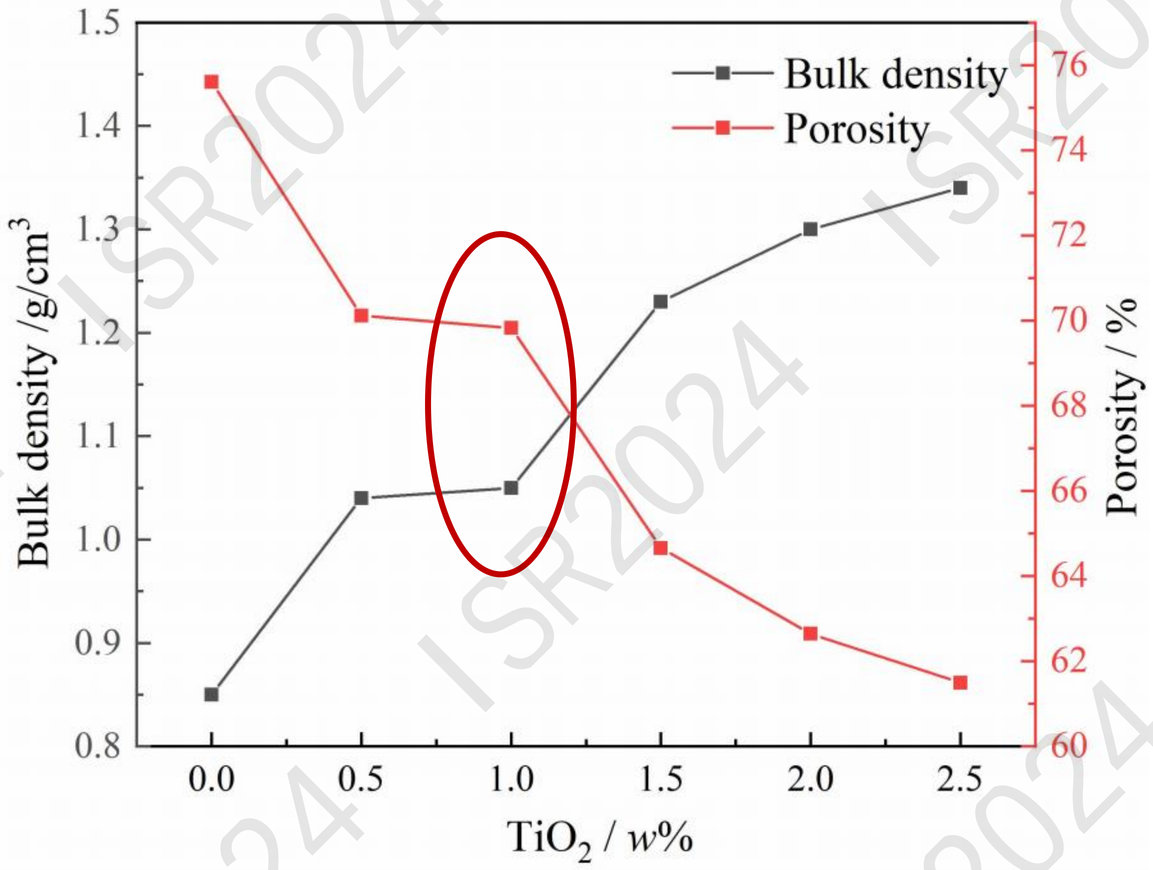


Fig.8 Effect of TiO_2 on bulk density and porosity of samples

With the increase of TiO_2 addition, the bulk density of the sample increases and the porosity decreases

Table I. Experimental formulation

Materials		A0	A5	A10	A15
Magnesia lightweight aggregates	3~1 mm	-	5	10	15
Sintered magnesia	3~1 mm	40	35	30	25
	≤1 mm	18	18	18	18
	≤0.088 mm	35	35	35	35
Hercynite	2~1 mm	7	7	7	7
waste paper pulp		3			

2.2.2 Lightweight periclase-hercynite bricks preparation

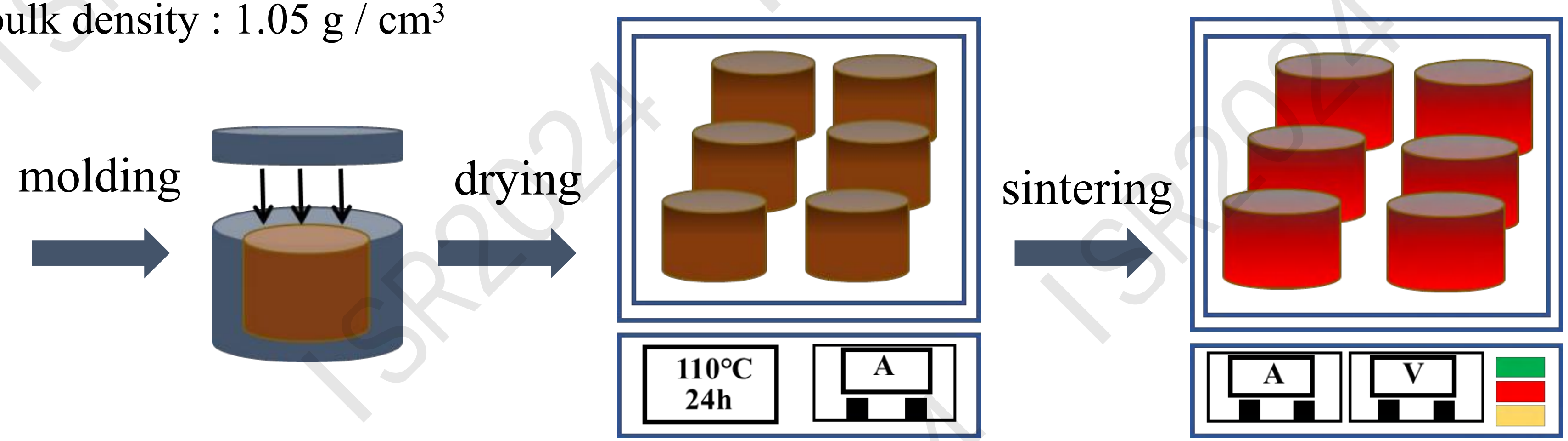
Sintered magnesia **Lightweight magnesia**

porosity : 69.85 %
bulk density : 1.05 g / cm^3

3-1

≤1

≤0.088



2.2.3 Physical properties of the samples

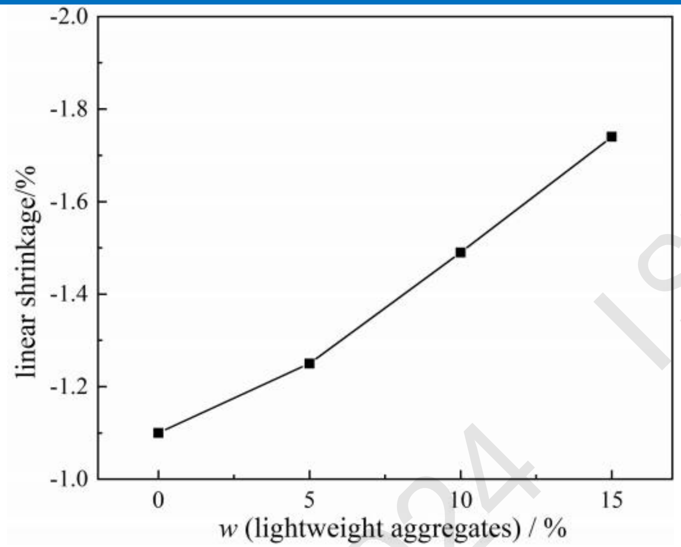


Fig.9 Linear shrinkage

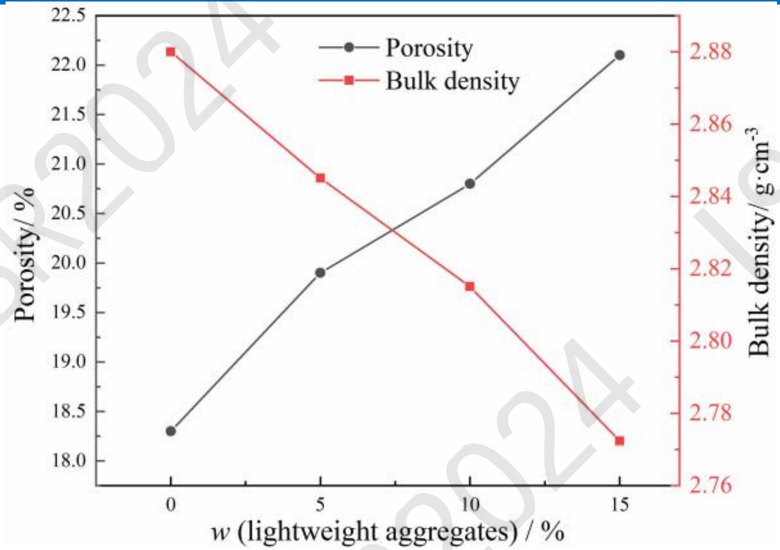


Fig.10 Porosity

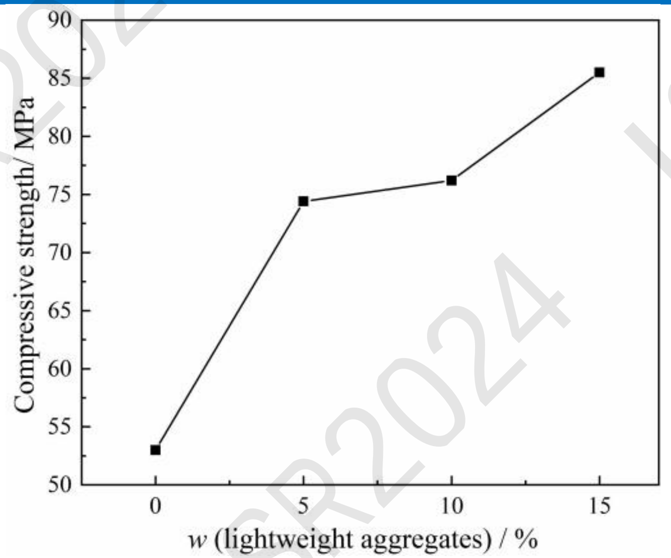


Fig.11 Compressive strength

Table II. Physical properties of the samples

Samples	Thermal shock resistance / number	Refractoriness under load / °C	Thermal expansion coefficient /$\times 10^{-6}$ K
A0	15	1550	12.91
A5	16	> 1700	12.19
A10	17	> 1700	12.50
A15	17	> 1700	12.96

2.2.4 Microstructure of the samples

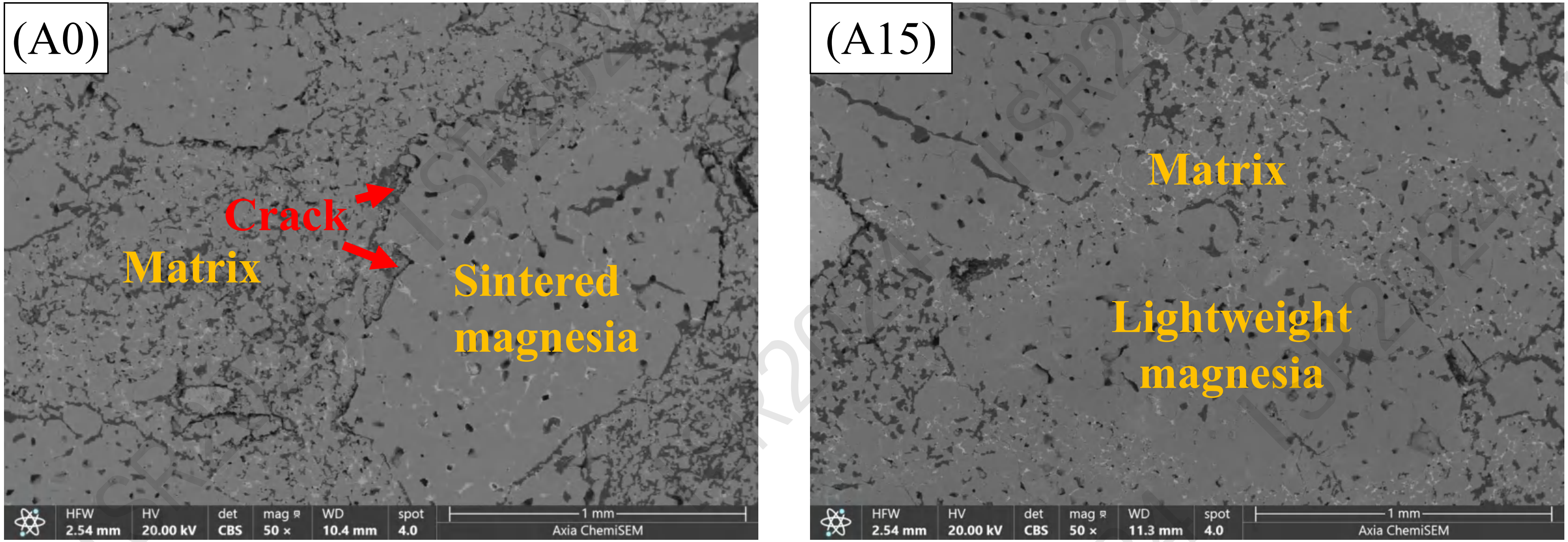


Fig.12 Microstructure of the samples

As for sample A0 containing dense aggregates, the cracks were very distinct between the dense aggregates and the matrix.

Compared with sample A0, the aggregate/matrix interface bonding of A15 was remarkably improved.

2.2.5 Microstructure of the corroded samples

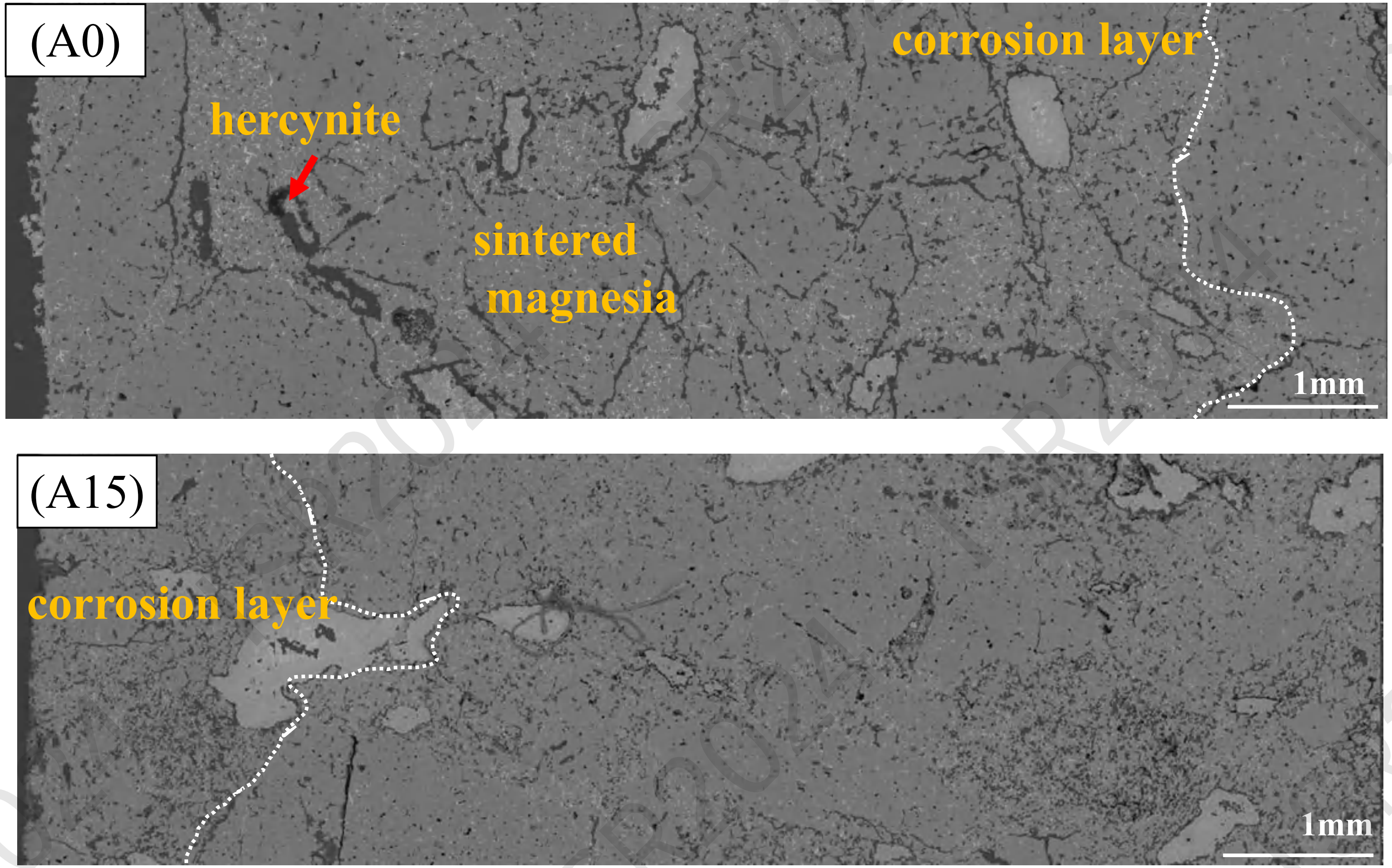


Fig.13 Microstructure of the corroded samples

The corrosion layer of pattern sample A0 is deep, a number of cracks appear, and the structure is loose. The corrosion layer of sample A15 is shallow, with less cracks and less silicate phase.

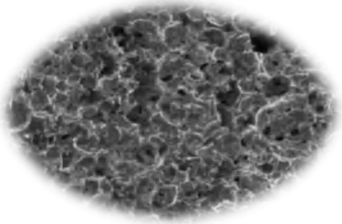
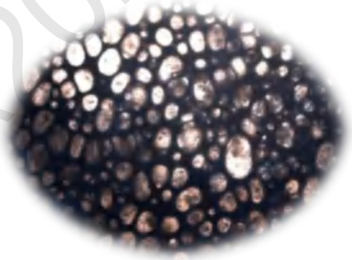
3. Conclusions

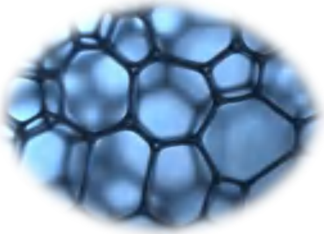
(1) With the increase of SDBS content, the number of bubbles in magnesia foam slurry increases, and magnesia can play the role of stability foam.

(2) With the increase of TiO_2 content, the bulk density of aggregates increases and the porosity decreases.

(3) With the increase of lightweight aggregates, the porosity of periclase-hercynite bricks increases, the bulk density decreases, the compressive strength increases, and the degree of corrosion decreases.

(4) The addition of lightweight periclase-hercynite brick has no strength and the thermal conductivity decreases, which can achieve the purpose of this study.



Thank you for listening

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