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Comparative analysis of high-temperature melt characteristics of different burden structures in blast furnace smelting process

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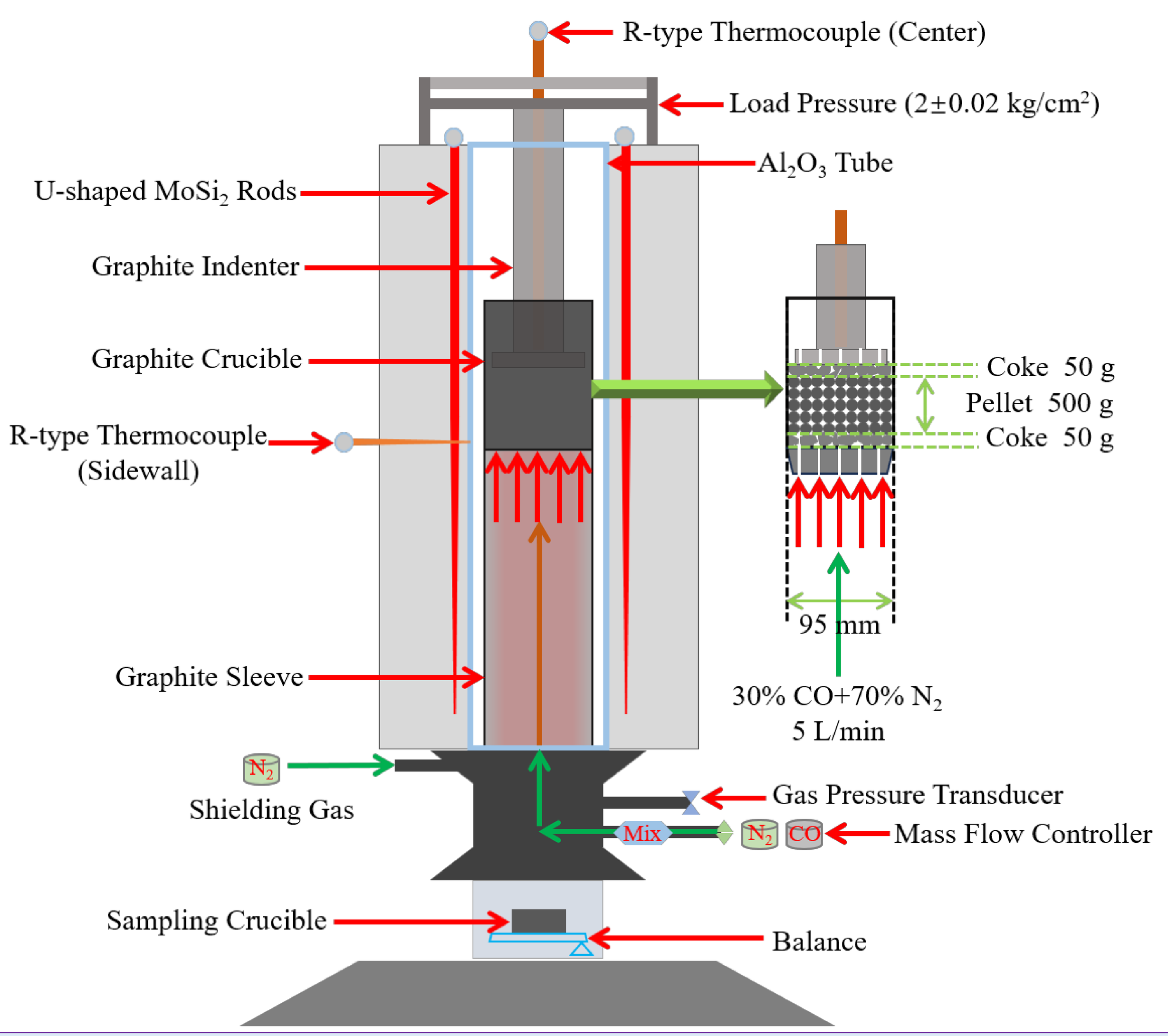
1 INTRODUCTION

Aiming at the differences in the high temperature melting properties of different vanadium titanomagnetite, the use of targeted operations in the blast furnace smelting process is one of the guarantees for efficient smelting in the blast furnace. In this study, three different types of acid pellets and fluxed pellets prepared from vanadium titanomagnetite were selected as the research objects, and the high-temperature melting properties of different burdens were studied comparatively by simulating the blast furnace smelting process through softening-melting-dripping experiments, in order to investigate the differences in softening-melting properties between different burdens.

2 METHODS

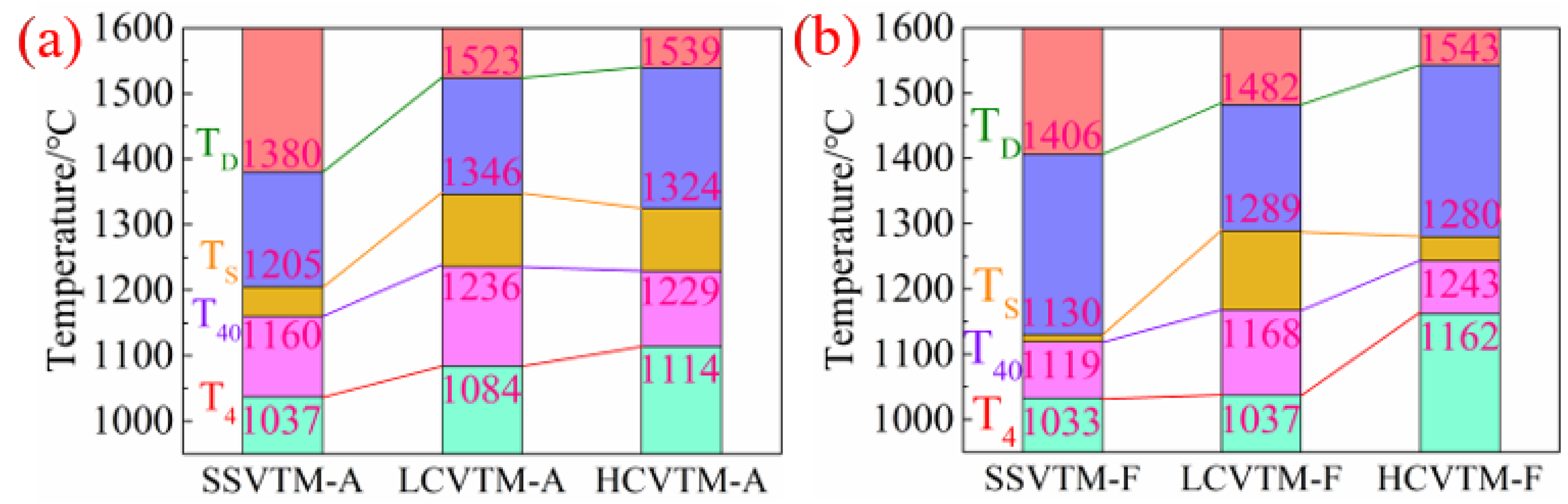


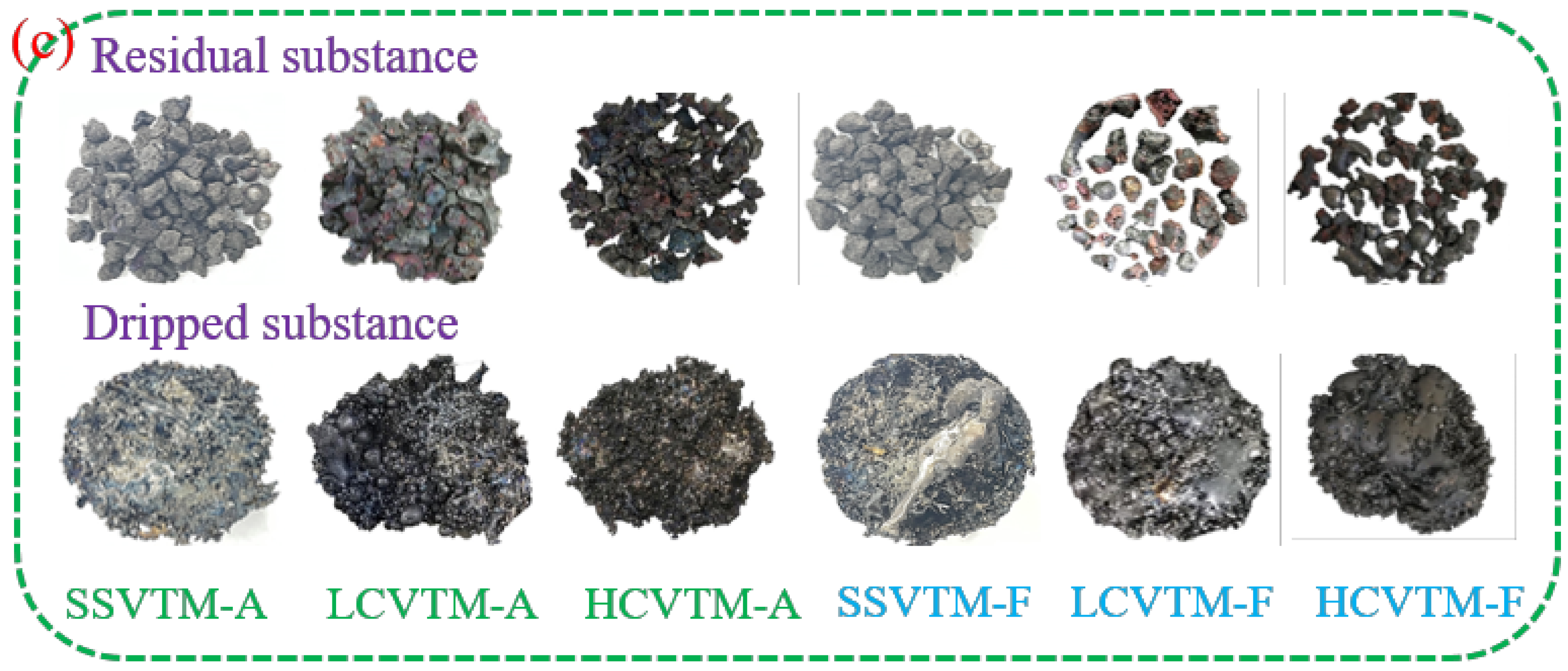
The titanium-bearing burden used in the experiments were acid and fluxed pellets (basic pellets) prepared from Sea Sand Vanadium Titanomagnetite (SSVTM), Low Chromium-bearing Vanadium Titanomagnetite (LCVTM), and High Chromium-bearing Vanadium Titanomagnetite (HCVTM), respectively. The softening-melting properties of the above pellets were carried out in the high-temperature softening-melting-dripping properties test furnace.

3 RESULT & SDISCUSSION

The table shows the temperature interval data of acid and fluxed pellets in the softening–melting experiments.
The figure (a) and (b) shows the softening–melting properties of acid and fluxed pellets. The figure (c) shows the residual substance and dripped substance morphologies of acid and fluxed pellets softening–melting in the performance experiments.

Materials	ΔT_1, $(T_{40}-T_4)$/°C	ΔT_2, (T_D-T_S)/°C	ΔT_3, (T_D-T_4)/°C
SSVTM-A	123	175	343
LCVTM-A	152	177	439
HCVTM-A	115	215	425
SSVTM-F	86	276	373
LCVTM-F	131	193	445
HCVTM-F	81	263	381





Acid

Compared with the softening–melting performance of SSVTM-A, the softening start and softening end temperatures of LCVTM-A and HCVTM-A were significantly increased, while the softening intervals became wider and then narrower.
The softening-melting intervals $[T_D-T_4]$ of LCVTM-A and HCVTM-A were significantly wider than those of SSVTM-A, which indicated the deterioration of softening–melting performance indexes.

Fluxed

Compared with the softening–melting properties of SSVTM-F, the softening start and softening end temperatures of LCVTM-F and HCVTM-F were significantly higher, while the softening intervals became wider and then narrower.
The soft-melting interval $[T_D-T_4]$ of LCVTM-F was obviously wider than that of SSVTM-A and HCVTM-F, which indicated that the deterioration of softening–melting performance index was more obvious.

4 CONCLUSION

1. The T_4, T_S and T_D of SSVTM-A were lower, and the softening-melting zone was higher. While LCVTM-A and HCVTM-A had poorer permeability and downward shifted softening-melting zone position.
2. For the fluxed pellets, the changing law of softening–melting properties was consistent with that of acid pellets.
3. The dripped substance of SSVTM-A contained less slag and had obvious metallic luster, while the residual substance of LCVTM-A and HCVTM-A adhered to each other and formed clusters. The dripped substance of SSVTM-F and LCVTM-F had obvious metallic. The dripped substance of HCVTM-F showed dark black colour and contained more titanium-bearing blast furnace slag.

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