DEVELOPMENT OF MULTI-STAGE STORAGE TECHNOLOGY FOR HIGH-TEMPERATURE WASTE HEAT DURING STEEL CONTINUOUS CASTING

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***Abstract**: In order to solve the problem that the heat supply and demand do not match the time and place in the waste heat recovery of continuous casting slabs in the existing iron and steel enterprises. This work aims to use the principle of phase change energy storage for multi-stage recovery and storage of high-temperature waste heat from continuous casting slabs, which can not only fundamentally realize the matching and utilization of heat in time and space, but also ensure efficient heat recovery efficiency. It greatly reduces environmental thermal pollution, has great promotion value and energy-saving benefits.*

***Keywords:** waste heat recovery, phase change energy storage materials, multi-stage, storage.*

1. Background

At present, the main methods of continuous casting slab waste heat recovery are heat pipe waste heat recovery and steam waste heat recovery. However, the above-mentioned methods can only achieve the absorption and utilization of heat at this time, and the recovery-storage-utilization of waste heat cannot be carried out. This will severely cause the limitation of heat recovery and utilization in time and space matching conversion.

2. Methods

Fig. 1 – Device technology roadmap

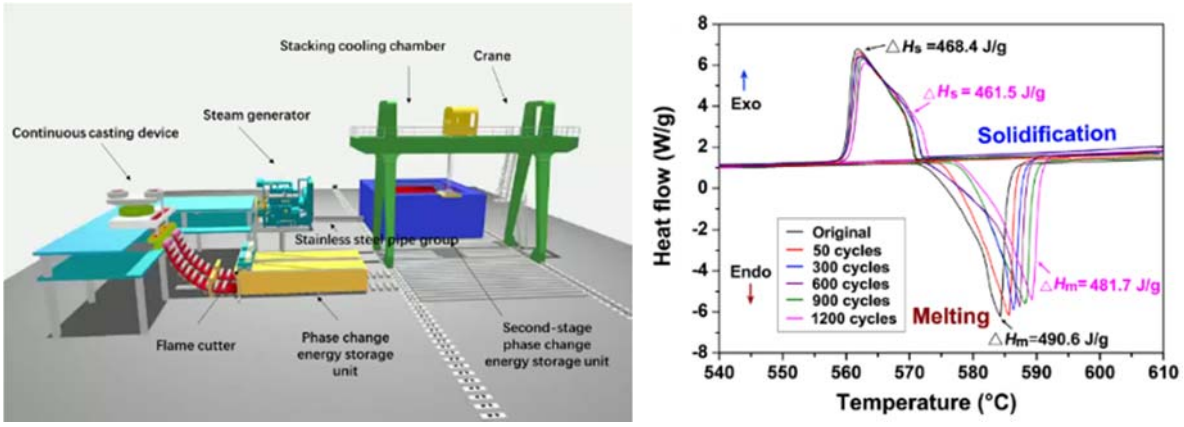

Fig. 2 – Device structure & Thermal cycle simulation results

The multi-stage recovery and storage device of high-temperature continuous casting slab waste heat is mainly composed of two parts, and its technical route is shown in Figure 1.

1) Waste heat recovery zone: use eutectic aluminum-silicon alloy and eutectic aluminum-tin alloy to recover high-temperature and medium-temperature waste heat of continuous casting slabs.

2) Waste heat utilization area: pass cooling water into the phase change energy storage units at all levels, superheat it into steam for power generation, and realize thermoelectric conversion.

3. Results and discussion

The structure design of the multi-stage recovery and storage device for high-temperature continuous casting slab waste heat is shown in Figure 2. In order to evaluate the thermal stability of the eutectic Al-Si alloy during the phase change cycle, a thermal cycle experiment was carried out, as shown in Figure 3. The results show that the latent heat of melting and solidification remain the original state after 1200 melting/solidification cycles. 98% of it has excellent thermal cycle stability.

4. Conclusions

1. For the first time, a new strategy of using phase change energy storage materials to recover, store and utilize the waste heat of continuous casting slabs is proposed.

2. Developed a multi-stage recovery and storage device for waste heat during steel continuous casting.

3. The whole system is a closed system, which greatly reduces the thermal pollution and water waste of the factory on the basis of ensuring the maximum heat recovery efficiency.