Improving Reliability of Thermite Head Repair Welding

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1. Introduction

Recently, rail failures have occurred occasionally due to rail head damage such as squats. In Japan, the damaged rails are replaced with the new rail and two welding executions are necessary. Thus, railway companies spend much time and cost on these repairs. If it is possible to repair the rail head damage without rail replacement, maintenance time and cost can be saved.

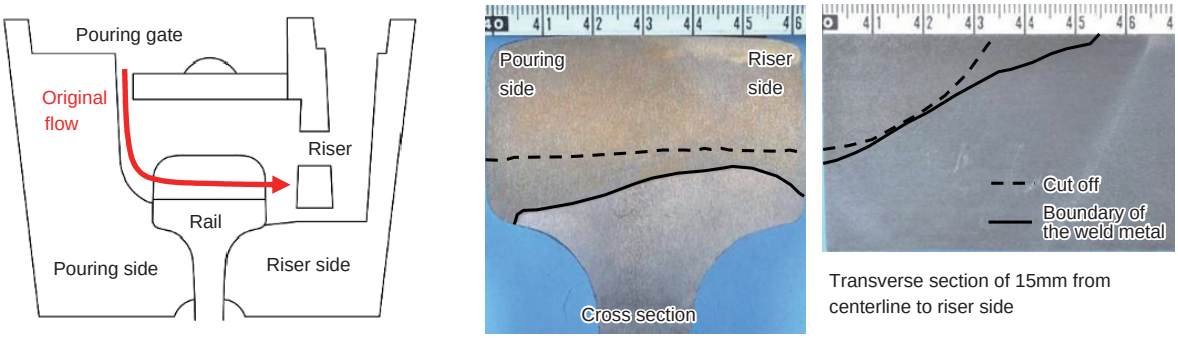
2. Outline

We took note of the Thermite Head Repair (THR) welding, technique that is performed speedily. THR have been performed in the U.K. In this method, only the damaged part of the rail is cut off and the thermite weld metal is cast in the mold set up on the repair part. Execution time of THR is roughly the same as conventional thermite welding and its estimated cost is one fifth of rail replacement. We examined several problems for the application of THR for JIS rails. In this article, we report on the influence of molten steel flow on the penetration to the repair part.

3. Test results

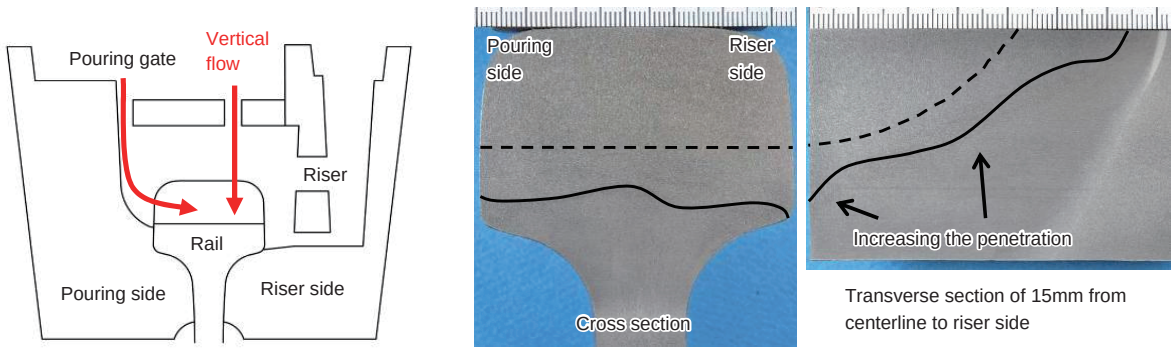
Figure1 shows the flow of molten steel and a typical shape of the penetration by the original THR mold for JIS rail. As shown in Fig.1, penetration is insufficient on the riser side, because the flow of molten steel occurs in only one direction from the pouring gate to the riser. In order to improve penetration, the flow of molten steel was examined with a view to optimizing the flow.

We developed a new mold system which can provide vertical flow to the previously insufficient area of penetration. Figure 2 shows the flow of molten steel and a typical shape of the penetration achieved by the new system. Uniform shape of the penetration was achieved by the vertical flow from a circular hole in the pouring plug. Some test welds were evaluated by means of rolling contact fatigue test and bending fatigue test with horizontal tensile force. As a result, it was identified that all test welds had adequate strength for practical use.



(a) Flow of molten steel (b) Typical shape of the penetration

Fig. 1 Flow of molten steel and a typical shape of the penetration by original THR mold



(a) Flow of molten steel (b) Typical shape of the penetration

Fig. 2 Flow of molten steel and a typical shape of the penetration by the new system