**2. Concept of Higher Performance**

**Fig. 4** show a macro photograph and the hardness distribution in welds after flash-butt welding of SP3, respectively. SP3 has excellent weld joint properties, as no cracks or other defects were observed in the welds, and the hardness of the welds was on substantially the same level as that of the base metal.

### 3.4 Evaluation Test on Actual Railroad

SP3 has been installed in curved sections of multiple heavy haul railways, and has been confirmed to provide excellent wear resistance and RCF resistance.

**Figure 5** shows an example of the result of an actual track test on a heavy haul railway. The wear resistance of SP3 displayed an improvement of about 25% compared with the conventional rail.

As described above, these tests confirmed that SP3 has sufficiently high performance even in the actual operating environment. SP3 also displayed excellent wear resistance in an installed test at the Transport Technology Center (TTCI: Transportation Technology Center, Inc.) in North America[6].

## 4. Conclusion

JFE Steel manufactures the high strength rail SP3 for heavy haul railways by refinement of the microstructure through optimization of the chemical composition and cooling technique.

SP3 has been confirmed to have excellent performance, and has been adopted in heavy haul railways in North America, Australia, and South America, where it is contributing to reduction of the frequency of rail exchanges and rail maintenance. In the future, it is anticipated that the needs for SP3 will continue to increase for further improvement of transportation efficiency, and expanded application to heavy haul railways is expected.

**References**

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