

Abstract:

Recently, weight reduction of car bodies to reduce the environmental load substance and workability improvement to enhance the international competitiveness have made progress in the field of automotive materials. Under such circumstances, steel materials are required to have super high tensile strength and to be able to deal with complex structures of parts with high performance. In the field of thick plates and steel pipes, trend of mega-structural construction and high efficiency transportation leads to the strict demand of thick and high tensile strength steel products. To fully utilize such advanced steel products, the innovation of welding technologies are necessary and various welding technologies have been developed and applied with the progress of steel materials. This paper introduces the developments and the actual applications of state-of-the-art welding technologies in JFE Group.

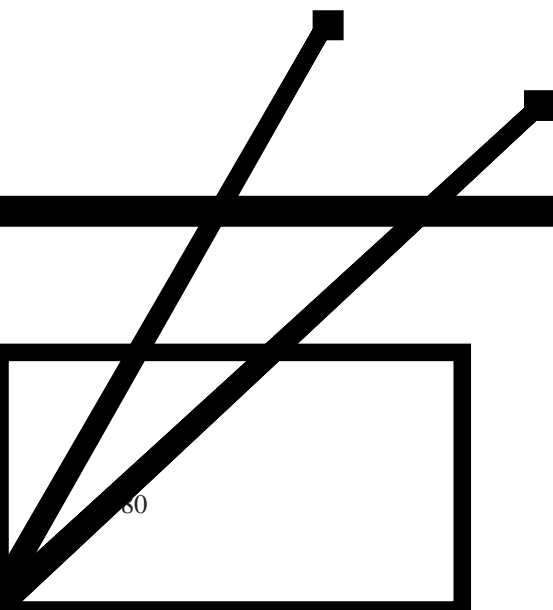
1. Introduction

In application of steel materials, while development

ity caused by shunting.

As a welding technology which accesses the weld from one side, laser welding is also an important candidate technology. Recently, a high efficiency welding technology called remote laser welding (**Fig. 4**) was developed thanks to progress in laser oscillators and peripheral hardware such as optical systems, and the technology has been applied widely, both in Japan and other countries⁹⁾. While many issues for laser welding technology remain to be solved, such as the cost of the equipment, safety countermeasures, etc., it is expected to be possible to satisfy both improved stiffness and reduced sheet thickness by application of high tensile strength materials by a changeover from point welding in resistance spot welding to continuous/linear welding¹⁰⁾. Moreover, expanded application of laser welding is also expected in the future by selection of laser welding methods suited to respective parts, for example, application of laser arc hybrid welding to autm a o # ,

as plate thickness increases, ultra-large heat input welding becomes unavoidable. As a result, it is difficult to obtain stable weld metal properties. Since dilution of the base metal is large, it is important to adjust the composition of the welding wire and flux corresponding to conditions, but composition adjustment of solid wires requires time and increases costs. Given this situation, technical development was carried out to enable quick,



arise when applying the complex phenomena that occur

ing its effectiveness in welding of long rails.

6. Conclusion

This paper has presented an overview of recent trends in the development of welding technologies in the JFE Group by reviewing typical technologies in the automotive material field and the plate and steel pipe fields. Trends in basic research on the microstructure of the weld metal, which has continued from an early date, technical progress by welding methods which are being promoted from the viewpoint of fatigue and fracture of welds, and recent quality control technologies for welds and joining technologies were also introduced. These technologies have already reached the level of practical application, and their application is necessary and indispensable presence as major key technologies when responding to the strict requirements placed on steel materials. JFE Steel is engaged in technical development on a daily basis in order to supply advanced steel products and state-of-the-art use technologies to customers.

JFE Engineering is endeavoring to achieve higher efficiency in welding and to secure stable quality in a diverse range of steel structure products. This paper introduced four examples of welding automation technologies which were developed independently by JFE Engineering. Because welding is a critical technology which holds the key to the safety of social infrastructure, industrial machinery, and energy-related products, the company is putting great effort into technical development in order to create the foundation for a safe and secure life.

The JFE Group is confident that progress in the development of these welding and joining technologies, use technologies, and automation technologies in the group will enhance global technological competitiveness while also contributing to society.

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