

FOREWORD

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Today, as we plunge into what has been called the “era of mega-competition,” the steel industry also finds itself in the very middle of the process of globalization. With world crude steel production now exceeding 1 billion tons, the ability to provide a stable supply of “high grade steel” is a distinctive feature of the Japanese steel industry. The design, development, and stable production of high grade steels such as high strength steels with excellent formability/toughness and excellent workability/weldability, high performance corrosion resistant steel sheets and chromate-free steel sheets which respond to environmental problems, is not possible without advanced characterization and analytical techniques.

The surface layer and microstructure of high grade steels are now controlled at the nanometer level. Physical analytical instruments which enables direct observation of the structure at this scale leads material development, and is also an essential tool for solving various kinds of production problems. At JFE Steel, we have elucidated the property microstructure relationships by using advanced electron microscopy and analytical techniques using high brightness synchrotron radiation, and based on this, we have presented guidelines for product development. Fast, accurate process analysis technologies, enables stable production of iron and steel products every day. We have therefore deepened our laser-based techniques and characterization techniques for trace elements and developed original methods which are being actively used in product analysis. We have also developed high speed process analysis techniques which enable feedback to quality control and are contributing to process optimization.

As examples of technologies used in the environmental businesses of JFE Engineering, we are contributing to the design of appropriate treatment processes by analyzing of the chemical bonding states of fly ash and sludge using high brightness synchrotron radiation source and rapid analysis of dioxins using gas chromatography.

In the JFE Group, JFE Techno-Research provides characterization/analysis developed and refined in businesses within the group, as well as strengthened analytical services matched to the needs of the customers and objects of analysis. New material characterization

using the ultra-low accelerating voltage scanning electron microscope and laser inductively coupled plasma (ICP) mass spectrometry respond to constantly evolving needs in material development and product quality assurance, and we are contributing to solving world environmental problems through characterization/investigation of trace environmental burden substances.

As basic technologies supporting all businesses, the JFE Group is continuing to strengthen technologies which reveal the nanometer world, technologies for accurate, rapid measurement of trace elements at the sub-ppm level, technologies for accurately measuring the coating weight and chemical changes of products in the production lines. Efforts in these various dimensions have enabled stable industrial production of products controlled to the nanometer level.

In the meantime, considering the large number of problems which still cannot be solved by characterization/analysis in both the field of steels and engineering, increasingly advanced technologies will be essential in the future.

This special issue introduces some of the above-mentioned efforts of the JFE Group by presenting examples of microstructure and surface analysis technologies which are leading product development, characterization technologies which support the production of high quality iron and steel products, and recent research achievements in “Only one” and “Number one” characterization/evaluation technologies which are also being supplied to clients outside of the JFE Group. The authors will be extremely pleased if these reports enable our readers to feel that the outstanding products and process technologies of the JFE Group are endorsed by high characterization/analysis capabilities.