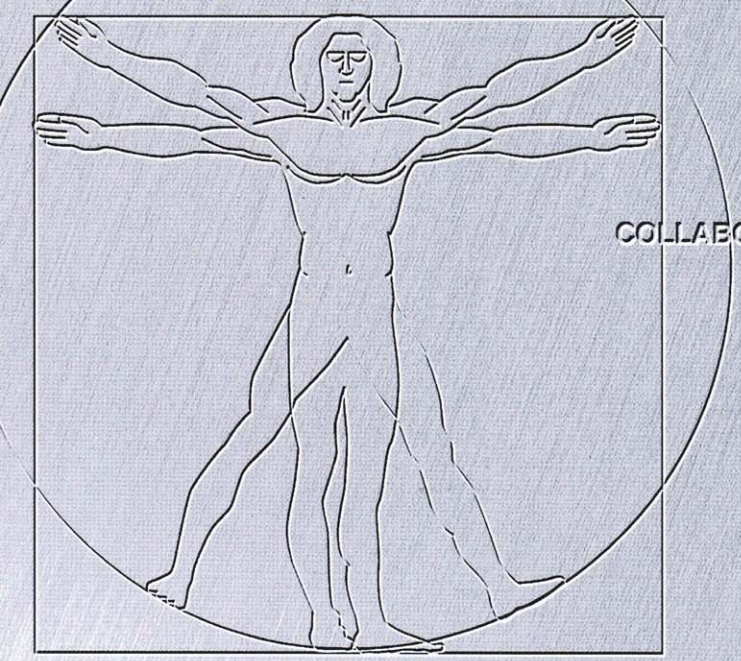
National Institute for Materials Science



COLLABORATION

COMMERCIALIZATION

RESEARCH

Steel Research Center

ULTRA-STEEL

We are promoting the fundamental research that supports manufacturing in the new era and developing original research that will open up the potential for Ultra Steel.

Artificial constructions like buildings, plants and vehicles have been made using plenty of various steels. Coming ages demand higher and comprehensive performance for the social, urban and industrial infrastructures. High safety and security, low environmental burden, long service-life, low maintenance cost and so on are totally required and steels as major material used are supposed to meet these demands. The Steel Research Center has promoted R&D for seeking and materializing "Ultra Steels" that exhibit extensively improved properties such as ultra high strength, superior heat-resistance, and revolutionary corrosion-resistance and further their joining technologies in collaboration with a wide range of scientists and technicians from maker-side to user-side.

Kotobu NAGAI
Director-General

Basic attempts for innovation of materials manufacturing
-Ultra Steels: seedling, raising and branching

Steel Research Center minds Ultra Steels that can fundamentally solve the global environment problems as well as the East Asian regional problems due to big earthquakes and high corrosion atmosphere, promotes basic researches on Ultra Steels with respect to materials fabrication, joining, and key-technology for application, and coordinates various types of scientific meetings and research projects related with Ultra Steels.

Metallurgical Processing Group

Long coil wire of ultrafine-grained steel for high-strength parts

Continual production method of long coil wire of ultrafine-grained steel as raw material of high-strength parts has been originally developed in collaboration with private sectors. High-strength parts can be fabricated only through forming the wire, and consequently the present multistep process, i.e. wire softening heat treatment, parts forming, parts quenching and parts tempering, will be substituted and the environmental burden be remarkably reduced due to disuse of any heat treatments.

Developed ultra steel wire coil with a diameter of 1.3mm and the length of 1km

Typical microstructure of the coil with a diameter of 6mm

Corrosion Resistant Design Group

Research and development of Ni-allergy-free stainless steel

As one of the safe materials for creating a safer, healthier and more pleasant social environment, Ni-allergy-free stainless steel is under research and development. This material is promising for application to bio/medical related parts.

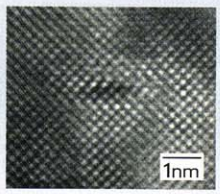
A stem for an artificial hip joint (Length:150mm)

Physical Metallurgy Group

A proposal for designing new steel structures by the development of ultra high strength bolts and by bolt joining

Developing high strength bolts over 1800 MPa class that are resistant to delayed fracture and proposing a new steel construction design using an ultra high strength fastener. (Note:The targeted strength level has been updated to a much higher strength limit than the 1100 MPa of conventional bolts.)

Formation process of high strength bolt (M22) in prototype steel
(1)raw material
(2)head forming
(3)thread forming

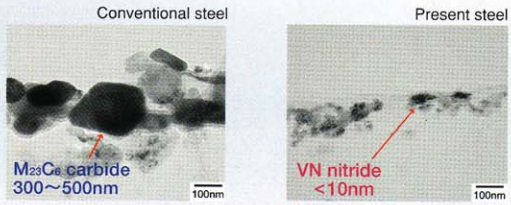


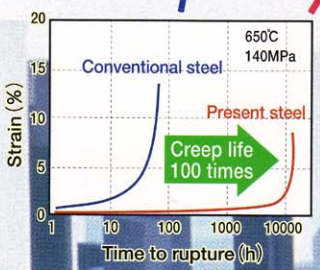
Overcoming delayed fracture by utilizing nano scale precipitates (1800 MPa steel).

Heat Resistant Design Group

Development of heat resistant steel strengthened by nano-size precipitates for 650℃ USC power plant

The high temperature creep strength of the advanced 9%Cr steel has been improved by dispersion of nano-size precipitates. This material is expected to realize an Ultra-Super Critical power plant, which contributes to reduction in CO_2 emission and conservation of energy resources.





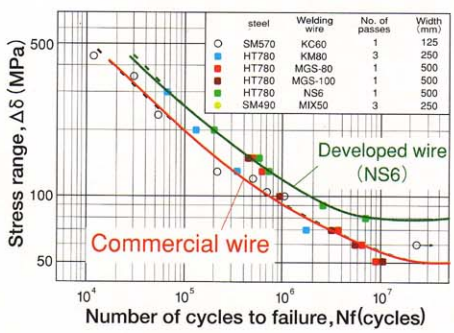
The creep rupture life of the steel that was strengthened by nano-size precipitates was extended one hundred times as long as that of the conventional one.

Welding Metallurgy Group

Development of new high strength welding wire for the improvement of fatigue strength of welded joints

The tensile residual stress reduces the fatigue strength in welded joints remarkably. While ultra-narrow gap arc welding process applied, by using the new developed low transformation-temperature (LTT) wire, the martensitic transformation expansion can reduce the tensile residual stress, and the fatigue strength can be improved along with safety.

Developed LTT wire for gas metal arc welding

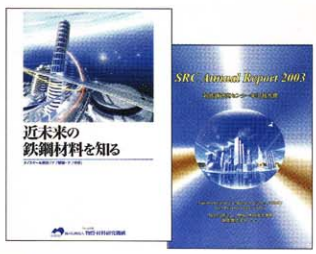


The fatigue strength was improved to twice the strength of conventional welded joints.

We are developing activities to grow new findings and expand the Ultra Steel field.

The Steel Research Center is promoting the practical application of Ultra Steel materials by cooperating with users of the materials, fostering private companies and giving instructions for commercialization of products. We are now promoting the second-phase Ultra Steel research project, the millennium relevant project and the transfer project.
In addition, we take a leading role in international Ultra Steel material research by hosting and coordinating the lecture meetings in cooperation with worldwide research institutes.

In the "transfer project," we are promoting the fundamental research and applied technologies necessary for practical application in collaboration with industries and universities. This project is promoted by the "Products Research Laboratory" in which the research is being advanced for commercialization of ultra-fine grained steel products, new welding wire, high nitrogen stainless steel products and so on. (The photo shows an example of a screw of ultra-fine grained structure.)



We are developing a wide range of PR activities, for example, by issuing the annual reports that collect the activities of the Steel Research Center and issuing brochures for students to easily understand the tendencies of the latest Ultra Steel research.

We host and co-host domestic and overseas lecture meetings and workshops regarding Ultra Steel. Particularly in the workshops, we provide places for discussions between researchers and engineers of both manufacturers and users to share information and recognition.

We exhibit samples of Ultra Steel products at the Ultra Steel exhibit space in the National Institute for Materials Science.

■Organization

Kotobu NAGAI
Director-General

Kaneaki TSUZAKI
Deputy Director-General

5 Research Groups

Kotobu NAGAI
Metallurgical Processing Group
(8 members)*

Kaneaki TSUZAKI
Physical Metallurgy Group
(7 members)*

Fujio ABE
Heat Resistant Design Group
(5 members)*

Yasuyuki KATADA
Corrosion Resistant Design Group
(4 members)*

Kazuo HIRAOKA
Welding Metallurgy Group
(7 members)*

*The number of full-time employed researchers is shown in parentheses. The Steel Research Center consists of more than 100 members, including STX visiting researchers and post-docs.

Contact us

National Institute for Materials Science (NIMS)
Steel Research Center
Center Office:1-2-1 Sengen, Tsukuba, Ibaraki, 305-0047 Japan
Phone:+81-29-859-2102 Fax:+81-29-859-2101
URL:http://www.nims.go.jp/stx-21/ E-mail:stx-21@ml.nims.go.jp