

Materials Research Laboratory

Our important contributions to the business divisions are made by strengthening their competitiveness and by the creation of new products. New products have been developed in the materials field by means of sophisticated materials and surface design technologies. In addition, manufacturing processes have been optimized. Advanced technological support is provided to the development of new products in the machinery field. Furthermore, our proprietary material technologies provide a firm base for the development of new business ventures.

Refining & Solidification

- High-Temperature Process Metallurgical Analysis
- Solidification Analysis
- Inclusions and Slag Analysis
- Special Melting & Casting Process for Reactive Metals

Materials Design

- Microstructural Control and Materials Design
- Prediction of Microstructures and Properties
- Evaluation and Analysis of Fatigue and Fracture Properties

Mechanical Working

- Rolling, Forging and Extrusion
- Cutting and Grinding
- Numerical Simulation and Process Design

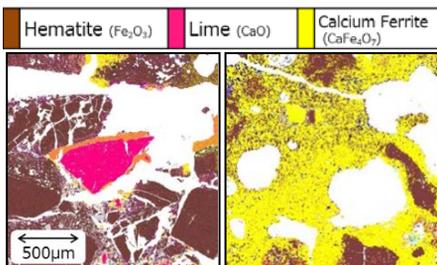
Surface Design & Corrosion

- Suppression of Corrosion and Embrittlement
- High-Functional Coat Design
- High-Temperature Resistant Coat Design
- Materials Design on Surface/Interface

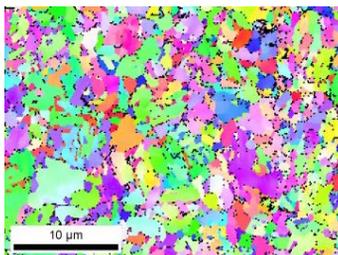
■ Achieved optimum process and high quality products using process simulation and reaction control technology.

■ Developed materials for next-generation lightweight vehicles using nano/micro level microstructural control technologies and materials design.

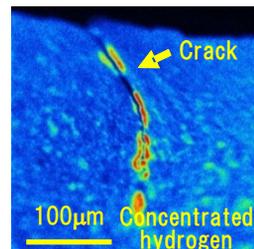
■ Improved anti-corrosion characteristics and reduced life-cycle cost using embrittlement/pitting corrosion behavior analysis technology.



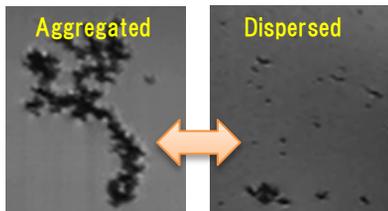
Mineral Phase Mapping



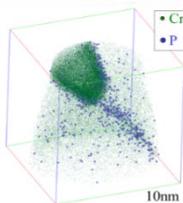
Microstructural Analysis (μm order)



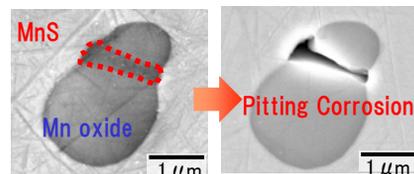
Analysis of Embrittlement Behavior



Control of Inclusion Morphology



Nano-structure Analysis (nm order)



Pitting Corrosion Analysis

Applications to Products and Processes

- Reduction of CO₂ emission
- Engine valve springs for automobiles
- Engine crankshafts for ships
- Aluminum disks for hard disk drives
- Copper alloys for electronic parts

Applications to Products and Processes

- High-strength steel sheets and aluminum panels for automobiles
- Fatigue-resistant steel for shipbuilding
- Low-temperature welding wire

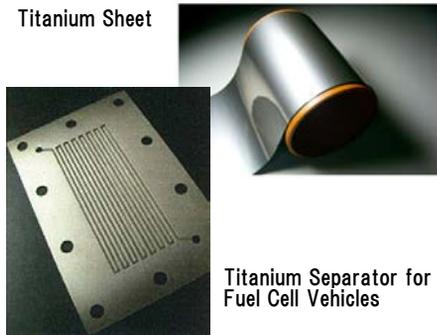
Applications to Products and Processes

- High-strength steel sheets for automobiles
- High-strength bolts

■ Commercialized production of titanium sheet for separators used in materials/surface-design and rolling technologies.

■ Optimized process conditions by estimating temperature/stress and shapes/qualities during and after rolling, forging, and machining using numerical simulation and trial experiments.

Titanium Sheet

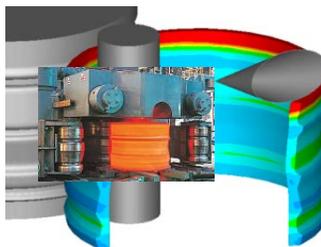


Titanium Separator for Fuel Cell Vehicles

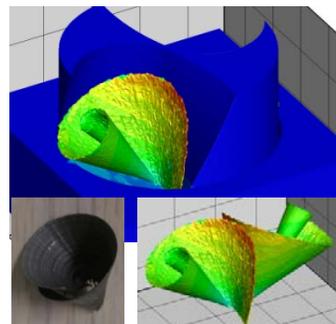
Rolling Technology and Surface Design

Applications to Products and Processes

- Fuel cell vehicle components
- Plate-type heat exchanger components



Numerical Simulation of Ring Rolling (V2500 Titanium Fan Case)



Numerical Simulation of Drilling

Analysis and Design for Manufacturing Process

Applications to Products and Processes

- Aircraft engine components
- Components for compressors and construction machinery