Special Feature 02
Responding to CASE, a Major Transition in the Automotive Industry

The automotive industry is undergoing a once-in-a-century transition as moves to CASE technologies (Connected, Autonomous, Shared & Services, and Electric) accelerate. As a company that has always worked to expand the potential of cars through specialty steel, forged products, and other materials and parts, Aichi Steel considers this transition as a new challenge and an opportunity to expand its business.

Going forward, we will further evolve the technologies we have cultivated so far, and develop and commercialize new materials, parts, and products, to contribute to a more environmentally friendly society where people and cars exist in harmony.

CASE trend

CASE is a field of technologies that are directly linked to the realization of a sustainable society facing a range of issues, including climate change, frequent traffic accidents, and depletion of scarce resources. By further strengthening development in this field, the Aichi Steel Group will promote ambidextrous management and improve medium- to long-term corporate value while helping to address social issues through its businesses. The elements of CASE technologies that we are focusing on in particular are electrification (E) and autonomous driving (A) technologies.

Electrification technologies are expected to contribute to low-carbonization and decarbonization across the entire lifecycle of cars, not just while driving.

We are therefore driving development to address the related issues of extended cruising range and resource scarcity risks.

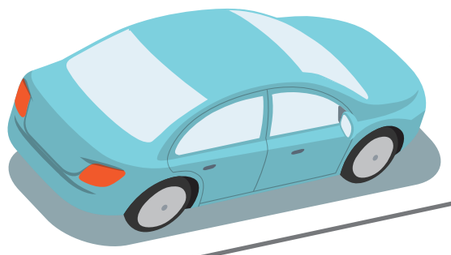
Autonomous driving technologies are expected to reduce traffic accidents and congestion, and bring the joy and freedom of mobility to all. On the other hand, vehicle-infrastructure cooperative systems that ensure safety, even when radars, image analysis, and AI are insufficient, are essential for social implementation, so we are developing these systems with a view to practical application.

C A S E

Expectations from society

E **Popularizing mobility that helps realize low-carbonization and decarbonization across the entire lifecycle**

Electrification technologies



A
- **Reducing traffic accidents and congestion**
- **Bringing the joy and freedom of mobility to all**

Autonomous driving technologies

Aichi Steel contributions

BEVs

Providing materials and parts that improve strength and durability while also minimizing the use of scarce resources
Cruising range / Resource risks

Providing electric axles that are compact, lightweight, resource-saving and that improve motor efficiency while increasing end-of-life resource recyclability
Cruising range / Resource risks

FCEVs

Providing materials that are highly cost effective and are hydrogen embrittlement resistant
Resource risks

HEVs, PHEVs, BEVs

Providing power card parts that have highcooling functionality, which can affect the performance of inverters
Cruising range

Providing autonomous driving support systems that are not affected by radio wave environments or bad weather, and that ensure a high level of safety through highly accurate identification of vehicle position
Safety and security

BEVs: Battery Electric Vehicles
HEVs: Hybrid Electric Vehicles
PHEVs: Plug-in Hybrid Electric Vehicles
FCEVs: Fuel Cell Electric Vehicles

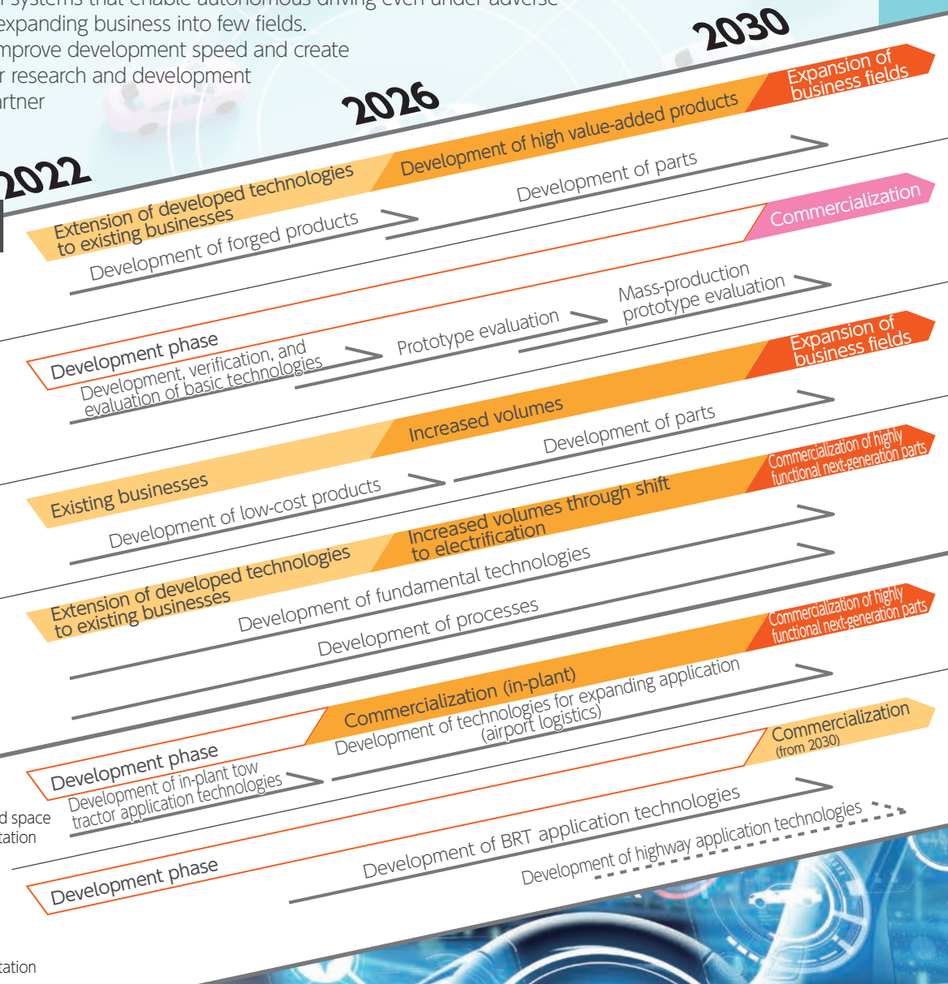
Vision and roadmap for 2030

Development policies

Responding to this transition in the automotive industry, the Research and Development Headquarters promotes development based on two policies: I. Focus on next-generation mobility development, and II. Beat the competition through outstanding development capabilities and development speed. Specifically, this means (1) developing materials and parts that support vehicle electrification with the aim of reforming existing businesses, and (2) focusing on development of systems that enable autonomous driving even under adverse conditions with the aim of expanding business into few fields.

We aim to dramatically improve development speed and create innovation by leveraging our research and development strengths and enhancing partner collaborations in Japan and overseas.

Specific initiatives (related to development)



Initiatives for realizing the roadmap

Research and development strengths

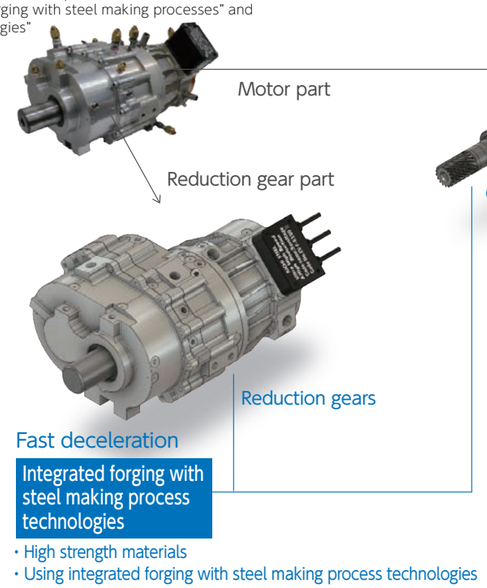
Industry's only integrated forging with steel making processes

We are leveraging the strengths of integrated forging with steel making processes, which enables in-house production of everything from steel material to forged products. This enables us to develop everything from materials to products at a single site through process integration while developing high value-added parts that contribute to lighter-weight, higher-performance automobiles.

Development based on integrated forging with steel making processes

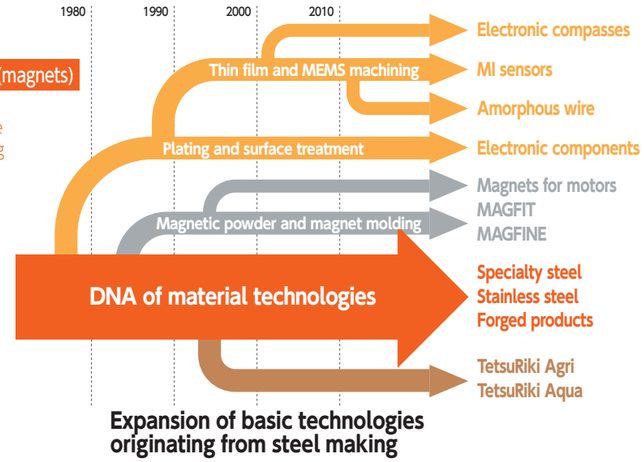
Material design technologies	×	Steel process technologies	×	Forging process technologies	×	Part process technologies
Realizing high functionality through composition design and solution technologies		Pursuing quality, cost, and delivery improvements through production process reform		Improving product value through development of technologies for pursuing net-shaping and low cost		Developing technology solutions for incorporation into customer processes and designs

Next-generation electric axle developed with the Aichi Steel strengths of "integrated forging with steel making processes" and "DNA of material technologies"



Development leveraging the knowledge of a materials manufacturer

Taking advantage of the DNA of material technologies passed down through successive generations, we will lead future generations through our manufacturing capabilities. In addition to existing products, we will develop new products that meet the needs and changes of society with the technologies we have cultivated and new ideas.



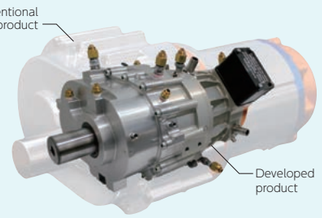
Product development

Steel and forged products for low-cost EV gear shafts

To meet the need for electric axles that are compact, lightweight, and low cost, we are developing high-strength steel, and low-cost steel without expensive alloy elements. We are also employing integrated forging with steel making processes, which merge forging technologies and materials technologies, to develop innovative techniques, and optimal materials, that enable improved added value and improved cost competitiveness of parts.

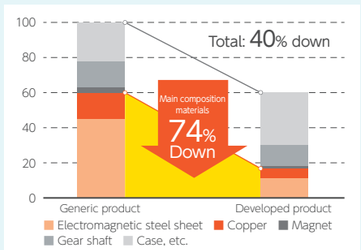
High-speed electric axles that are compact, lightweight, and resource-saving

With increased electrification of cars, demand for the rare earths (scarce resources), electromagnetic steel sheets, and copper used in car motors has increased rapidly, which has led to major risks associated with stability of supply and the environment. To help address these issues, we are integrating our proprietary MAGFINE anisotropic bonded magnets together with specialty steel, and developing them for application to next-generation electric axles that are compact, lightweight, resource-saving and highly efficient.



Next-generation electric axle being developed for practical use (40% smaller than conventional products in terms of volume and weight)

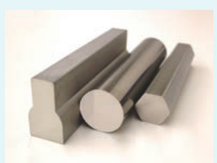
Weight comparison of main composition materials for electric axles



Low-cost stainless steel for use with high-pressure hydrogen

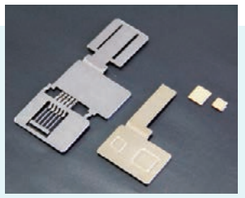
We are developing stainless steel for use with high-pressure hydrogen to help popularize fuel cell vehicles (FCEVs) and quickly realize the hydrogen society. With solid technical capabilities cultivated through years of stainless steel manufacturing, we have developed high quality, high functionality steel that Toyota is using in its MIRAI FCEV. We have also led the way by building systems for testing and evaluating steels under high-pressure hydrogen environments, including the world's first high-speed fatigue test apparatus that we developed. To help reduce costs as well, which are a major issue hindering the popularization of FCEVs, we are stepping up efforts to develop resource-saving, low-cost products.

Hydrogen filling nozzle made with Aichi Steel stainless sleet

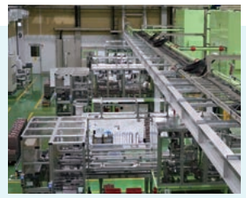


Power card lead frames

Electronic components are essential elements of next-generation cars that make use of many different electronic devices. For more than 30 years, we have been researching surface treatment technologies, with a focus on products for cars from 1996. At the moment, we are using our precision press technologies and highly reliable plating technologies to supply the power card lead frames, which are receiving good feedback from the market, that are essential for HEVs and BEVs. We are also continuing product development to meet the increasingly sophisticated needs of customers.



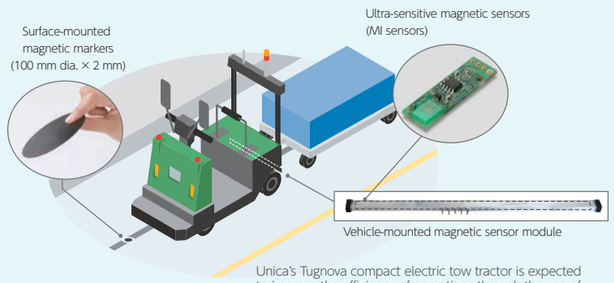
Lead frames



Lead frame production line (Gifu Plant)

GMPS autonomous driving support system

We are working on development of a GMPS autonomous driving support system that uses MI sensors to detect magnetic markers on roads for cars to estimate their own position. With research starting globally more than 30 years ago, we started demonstrating this technology at EXPO 2005 AICHI with vehicles, etc. inside the venue. High cost is one issue that must be addressed before this technology can be put to practical use. However, we have paved the way to successful implementation through development of ultra-sensitive MI sensors, design of low-cost, weak-magnetic-force magnetic markers, and development of our own magnetic field noise elimination system. We have made steady progress in development through verification trials conducted with national and local governments and partner companies. Going forward, we will accelerate our development program to quickly commercialize these technologies for use within defined areas, such as factories, and to implement them in society for use in open areas.



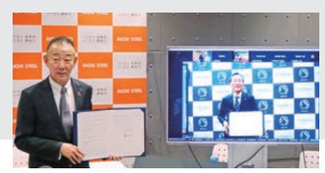
Unica's Tugnova compact electric tow tractor is expected to improve the efficiency of operations through the use of autonomous vehicles within factories

TOPICS

Partner collaborations

We are expanding collaborations with specialized institutions in Japan and overseas while searching for next-generation business fields and developing products with a focus on mobility and manufacturing.

In October 2021, we concluded an organizational cooperation agreement to improve the quality of our industry-academia activities, including joint research and creation of new projects with Tohoku University, and to expand the scope of our partnerships by strengthening organization-to-organization ties. As part of this framework agreement, and with the aim of accelerating research and development toward achieving carbon neutrality, we also established and began activities through the "Aichi Steel x Tohoku University, Materials & Process for the Next-Generation Electric Axle Co-Creation Research Institute" with a view toward the next-generation mobility era. We are also promoting practical application of research outcomes in society through industry-academia partnerships in every field where mutual cooperation is possible, including research and development, and creation of new projects.



Press conference announcing the Co-Creation Research Institute, jointly established with Tohoku University