

Automotive Materials Business Taking Advantage of Group Value

Automotive materials are a strategic product and identified as one of the major policies in UACJ's mid-term management plan, "Global Step I."

In addition to the prospect of continued growth, the strengths of UACJ, which has six different operations, can be utilized in this area.

We are currently working to reinforce our supply network and R&D activities in order to respond to the expanding market.

UACJ Strengths

Supplying a Wide Variety of Aluminum Products That Support Improving the Environmental Performance of Automobiles

With environmental issues in the spotlight, environmental regulations have been tightened on cars around the world in recent years. All automotive manufacturers are focusing on reducing emissions and improving fuel efficiency. To achieve these objectives, it is essential to reduce the weight of the vehicle body and improve the combustion efficiency of engines. To this end, automotive manufacturers are seeking to reduce the weight of vehicles by using different materials for parts, bodies and other components. In the midst of such a trend, aluminum is attracting attention because of its light weight, having a specific gravity as low as approximately one-third that of iron.

In addition to being lightweight, aluminum's characteristics include excellent strength, workability, erosion resistance, thermal conductivity, and recyclability. Because of these properties, to date it has been used in a large number of key parts such as engines, transmissions, and wheels. On the other hand, for body panels and frames, the use of aluminum has been limited to some special cars, partly due to cost restrictions. However, ahead of the introduction of more stringent fuel economy standards across the globe in 2020 and thereafter, aluminum body sheet and frames have been recently finding their way into

some mass-produced models of high-end sedans and sports cars. Aluminum is expected to be introduced for use in other parts through technological development in the future and adopted for a wider variety of components.

Amidst these trends, UACJ is producing an extensive range of automotive aluminum parts by drawing fully upon the strengths of technological prowess and expertise that the company has accumulated through its six businesses. By taking advantage of this feature, having been involved in as many as six different business domains and producing a wider variety of aluminum parts required by the automotive industry, UACJ aims to enhance its presence as a solution provider in the drive for lighter cars and to help improve the environmental performance of automobiles.

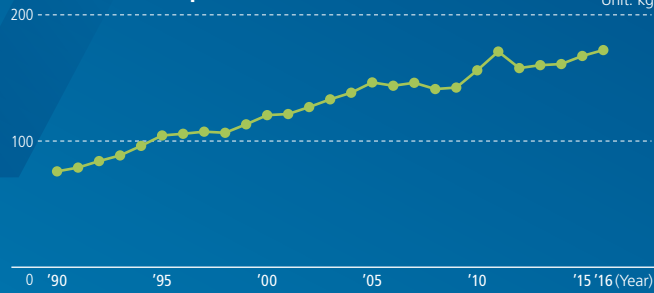


Fuel efficiency standards in Japan, US and Europe Unit: km/l

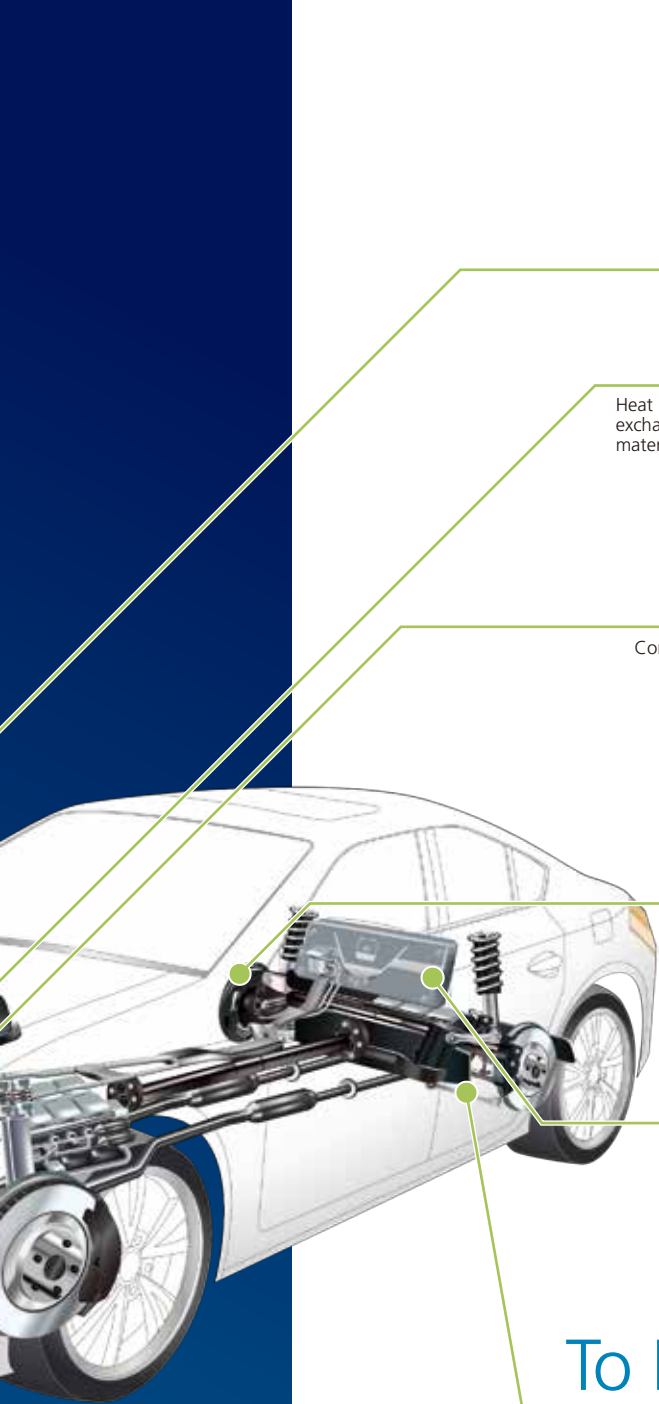


Source: Jidosha Alumika linkai (Automotive Aluminization Committee) of Japan Aluminum Association

Aluminum used per car Unit: kg



Source: Japan Aluminum Association website
Note: The amount of aluminum used per car denotes total automotive aluminum product volume divided by Japan's automotive production volume.



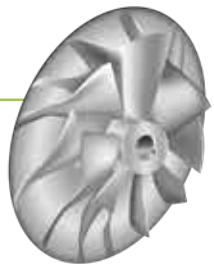
Hood

Flat Rolled Products Business



Heat exchanger materials

Casting products, including doors, bonnets, and roofs, and heat exchanger materials, etc.



Compressor wheel

Casting and Forging Business

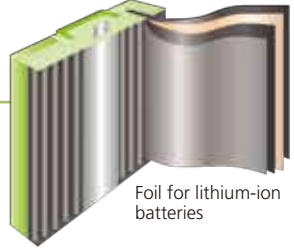
Turbochargers, compressor wheels, etc.



Commutator

Copper Tubing Business

Motor armatures for automotive electronics (commutators)

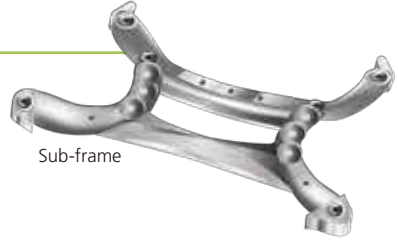


Foil for lithium-ion batteries

Foil Business

Materials for positive/negative electrodes in lithium-ion batteries (aluminum foil, copper foil)

To Become a Solution Provider for Lighter Cars Utilizing the Advantage of Six Businesses



Sub-frame

Extrusion Business

Heat exchanger materials and structural materials that require strength, such as sub-frames



Bumper

Precision-machined Components Business

Bumpers, subframes, etc.



UACJ Today

Producing Synergies through Aggressive Investment in Growth Markets and the USA

Establishing a Foundation for the Automotive Materials Business through Effective Investment Based on TAA

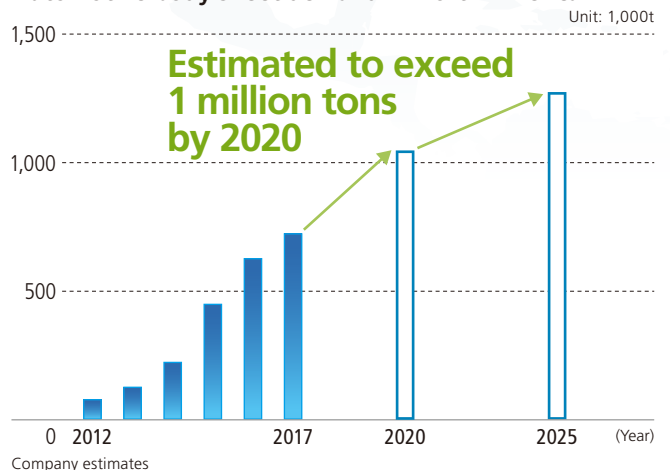
UACJ started full-fledged entry into the US market, the world's largest market for aluminum cans, in August 2011, before integration began. This move started with the acquisition of present-day Tri-Arrows Aluminum Inc. (TAA), which holds 60% share of the Logan Mill, the world's largest aluminum rolling mill. That event marked a huge step for UACJ towards becoming a global manufacturer of can stock.

North America is currently attracting a great deal of attention as a new growth market for the aluminum industry. The driver of demand there is the automotive industry. In the major automotive markets around the world, environmental regulations have become increasingly stringent on automobiles in recent years. In the USA, where regulations are more likely to drive incentives for lighter vehicles, a shift towards aluminum has been progressing steadily for body sheet and spaceframes, with the aim of reducing the weight of vehicle bodies. The demand for automotive aluminum products is projected to reach over 1 million tons in 2020 and 1.2 to 1.3 million tons in 2025.

In order to ensure that UACJ will capitalize on this once-in-a-lifetime business opportunity, in 2014 the company entered a joint venture with a European company to manufacture and sell automotive body sheet, thereby establishing Constellium-UACJ ABS LLC (CUA). Furthermore, UACJ implemented an additional investment in the Logan Mill of TAA—hitherto a specialist factory for can stock—to establish a network capable of supplying CUA with base materials for automotive body sheet. Moreover, in order to bolster its



Automotive body sheet demand in North America





automotive aluminum structural materials and parts business, UACJ welcomed North America's leading company in the field to the Group in 2016, launching it as UACJ Automotive Whitehall Industries, Inc. (UWH). This move is expected to produce synergies such as CUA potentially benefitting from the introduction of UWH's extensive clientele.

UACJ has established a network that enables the company

to move forward with its business for a wide range of automotive materials in a short space of time, doing so by carrying out effective investment based on the existing facilities of TAA. We will continue to improve our quality, cost and delivery performance, utilizing synergies created within the UACJ Group, and strengthening and expanding our automotive aluminum business in the North American market.

Global Operation of Automotive Materials Business by Leveraging of Expertise and Presence in North America

The trend towards lighter vehicles as a result of tighter regulations has been steadily gathering momentum beyond the US market, in Europe, Japan, and Asia as well. UACJ is planning to strengthen and expand its businesses of automotive body sheet and structural materials/parts operations in Japan, Thailand and other regions in the future, while taking advantage of its business model and presence among customers in the USA. With this vision in mind, UACJ has already started actively promoting the exchange of personnel and joint development with CUA and UWH. In particular, UWH has abundant experience in the parts and precision-machined components business, having undertaken designing and manufacturing automotive aluminum structural materials internally and delivering directly to automotive manufacturers. With such know-how added to its armory, the UACJ Group automotive materials business is set for further advancement.



PICK UP

Conducting Regional Activities through Interaction with Charity Organizations

As it does worldwide, the UACJ Group attaches importance to good relationships with local communities and is as committed to this cause in the USA, one of the key regions in the Group's overseas operations. At TAA, we have formulated a new vision to promote volunteer activities for local communities by the employees with the aim of becoming a cherished member of the community. Under this vision, TAA has designated five charity organizations that have connections with Louisville, Kentucky, as its partners. The company has made various donations, with many of its employees participating in activities hosted by the organizations. In addition, the activities are reported in an internal magazine to ensure that more employees are encouraged to take part. TAA continues its efforts to build even better relationships with all stakeholders, including staff, local communities and the industry.



Participating in the "Red Nose Day" event, which highlights child poverty, wearing a red nose like that of a clown and sharing laughs, as well as participating in a water-color painting club where locally produced wines are also enjoyed, TAA employees are developing their relationships with local communities.

Future of UACJ

Creating New Demand for Aluminum through R&D Focusing on the Future

Enhancing Automotive Materials and Precision-Machined Components Businesses Ahead of the Arrival of the Electric Vehicle Era

With environmental regulations becoming more stringent on automobiles, following the trend for lighter cars, the future is one of next-generation eco-conscious vehicles, electric vehicles (EVs). When the dissemination of EVs accelerates and the mainstream of automotive power shifts from combustion engines to electric motors, various parts constituting a vehicle will inevitably undergo dramatic change. In emission-free EVs, emission-related components such as catalysts and exhaust systems will become obsolete. Heat exchangers such as radiators used for cooling engines and transmissions will be replaced by parts to cool high-power components. Meanwhile, core parts vital for EVs are drive motors and large-volume storage batteries.

UACJ considers this tendency towards EVs a massive business opportunity and is operating an automotive aluminum business that responds precisely to changes in the market. With regard to storage batteries, we offer a wide array of products, including aluminum foil used for electrodes in lithium-ion batteries and aluminum alloy sheets for battery casings. We will continue to pursue higher performance and quality in line with market requirements.

Additionally, the trend towards aluminum body sheet and structural materials is expected to gather further momentum into the forthcoming EV era. For EVs equipped with heavy, large-volume storage batteries, reducing the weight of the body is an even more crucial issue than that for gasoline-powered vehicles in order to ensure longer ranges. Working closely with

CUA and UWH, which have been producing results in the North American market, UACJ will strive to meet these requirements. In particular, extruded aluminum materials, one of UWH's strong areas, has the advantage of being able to be cast precisely into extremely intricate component shapes. We are aiming to produce and supply high-strength structural materials for EVs for automotive manufacturers and parts manufacturers utilizing UWH's technologies and expertise in aluminum extruded materials. By doing so, we see this as a chance to expand the precision-machined components business. Moreover, new entries to the EV market have been increasingly active beyond traditional automotive manufacturers, including IT companies and venture businesses that have no existing supply chains for automotive parts. The market will have no fixed customers, such as subsidiaries and affiliated companies. This should provide us with an opportunity to cultivate new customers for our parts and precision-machined components businesses.

Pursuing Next-Generation Materials and Production Technologies by Participating in National Projects

In order to spark demand for aluminum products in the automotive materials market, which is expected to grow, and improve the performance and quality of materials, it is also imperative to solve various technical issues, such as developing new applications through the innovation of processing and joining technologies, and reducing cost.

For example, UACJ has jointly developed a new friction stir welding (FSW) technology with a major automotive parts manufacturer. The technology will be put to practical use as a tailored-blank technique that involves joining aluminum sheets with different thicknesses together, contributing to improved productivity and cost savings in aluminum automotive parts



Kazuhisa Shibue

Chief Executive, Research & Development Division
 Director, Member of the Board
 Senior Managing Executive Officer

New car sales results and targets for next-generation vehicles

	2015 (Actual)	2030 (Target)
Conventional vehicles	73.5%	30–50%
Next-generation vehicles	26.5%	50–70%
Hybrid vehicles (HVs)	22.2%	30–40%
Electric vehicles (EVs)	0.27%	20–30%
Plug-in hybrid vehicles (PHVs)	0.34%	
Fuel-cell vehicles (FCVs)	0.01%	Up to 3%
Clean diesel vehicles (CDVs)	3.6%	5–10%

Source: Ministry of Economy, Trade and Industry, Japan's Measures to Promote Next-Generation Vehicles

Expanding Businesses through the Promotion of Cross-Group Strategies and Marketing

Worldwide fuel consumption restrictions against the backdrop of environmental issues, combined with the arrival of zero-emission vehicles (ZEVs), mean that the need to reduce the weight of vehicles has expanded beyond automotive body sheet to other automotive parts and materials. Consequently, the automotive aluminum business is expected to grow rapidly both in Japan and overseas. We feel that it will be even more important in the future to provide customers around the world with solutions that meet requirements for lighter weight and higher performance, including design, processing and joining technologies, as well as optimal materials such as sheets and extruded materials. In light of such changes in the market environment, the Automotive Business Development Division was launched in October 2016 in order to ensure that the UACJ Group grabs this business opportunity. This division is responsible for collecting and centralizing information on the market environment surrounding new automotive products and technologies and trends in customer needs. By doing so, the new department will draw up cross-group strategies based on the resources of all Group companies and carry out marketing with the aim of further expanding the automotive business.



Takehide Otani

Chief Executive, Automotive Business Development Division Executive Officer

production. Apart from this, UACJ has been studying an array of joining technologies, including laser welding and adhesive bonding. When the aspect of strength enters into the equation, it is difficult to design the whole part using a single lightweight material. Given the sophistication of technologies to join aluminum with other lightweight materials, such as carbon-fiber-reinforced plastics (CFRPs) and resins, we are convinced that aluminum will be used even more extensively in the automotive industry.

We are also committed to more innovative R&D. As part of these initiatives, UACJ is taking part in a project organized by the New Energy and Industrial Technology Development Organization (NEDO) to develop high-strength and high-toughness aluminum alloys under a university-industry partnership. The aim of this initiative is to develop the world's strongest aluminum alloys to be produced in Japan in order to reduce the weight of aircraft and improve fuel consumption. The technical achievement of the project should eventually be passed on to product development in the automotive field. In another project led by NEDO, UACJ is undertaking the development of an innovative technique that enables a substantial reduction in power consumption when compared to the traditional aluminum smelting process. There are still many hurdles to be overcome before practical use begins; however, when this is achieved, aluminum's cost competitiveness against other materials will be boosted, leading to wider use of

aluminum beyond automobiles.

Additionally, as a result of the rapid advance of the Internet of Things (IoT) and artificial intelligence (AI), the manufacturing industry is now facing dramatic changes in production processes. UACJ is also faced with challenges as to how to handle these changes, but we are determined to address them positively.

Tougher environmental regulations and technological evolution mean a steady increase in the amount of aluminum used per vehicle every year, and we expect this trend to continue. Within the company, as well, UACJ will strive to create new value for the expanded use of aluminum by developing joining technologies and R&D that help lower cost.

