

The 46th Tokyo Motor Show

Implementation of Aluminum Body Panels Still Faces Challenges

By Tai Nakada, Nalk Corporation

The 46th Tokyo Motor Show 2019 was held at the Big Sight venue in Tokyo, Japan with the theme “Open Future.” In addition to displays of conventional automobiles, various automobile manufacturers featured their displays on electric vehicles (EVs), autonomous vehicles, and concept cars envisioning forward thinking designs, such as mounted drones. In addition, for the first time there were hands-on displays, including an area for a compact mobility experience.

As was the case two years ago, explanations were given by various design personnel about the usage status of aluminum body panels. Aluminum body panels are considered to be the key to lightweight vehicles, and as such the demand thereof is increasing around the world. However, discussions with Japanese automakers at the Tokyo Motor show illustrated that there are several factors—such as issues with cost, formability, and difficulties with multi-material joining—that continue to hinder the implementation of aluminum body panels, particularly for smaller economy vehicles. This trend was more clearly defined at the 2019 show than it was two years ago. This article highlights some of these discussions and considers the trends impacting the demand for aluminum in Japan.

Noteworthy Vehicles

Subaru Levorg: The all-new Levorg prototype was unveiled in Tokyo (Figure 1). According to Subaru, “In a mobile society where autonomous driving is widely spreading, this is a performance wagon which achieves a future that everyone can enjoy driving at their fullest, at their will.”



Figure 1. Subaru's Levorg is a portmanteau of three words: Legacy, Revolution, and Touring.

The Subaru personnel at the show indicated that the company plans to adopt aluminum for the fenders and hood of the concept car. It was pointed out that the issue with aluminum continues to be formability. The company believes that for the trademark horizontal centerline that runs across the car body, aluminum is lacking in the ability to reproduce its sharpness here. In addition, compatibility with other materials remains a challenge as cracks in the paint occur at the joining parts of different materials.

With respect to the hood, the adoption of aluminum body panels was underway two years ago, due to the material's ability to absorb impact and therefore increase safety. However, from the perspective of spring features, steel materials were reconsidered.

Regarding the use of aluminum body panels in the future, amid the lightweighting trend, Subaru feels that aluminum is an appealing material and they are proactively considering its use on roofs and other areas. It was interesting that although Subaru felt that the combination of different materials posed a challenge two years ago and their basic policy was to use steel and high-tensile strength steel to the fullest, this year they showed a proactive stance toward the use of aluminum panels.

Nissan Ariya: During the show, the Nissan Ariya was unveiled for the first time to the world (Figure 2). The vehicle is a crossover EV concept car, a new symbol of the company's vision, “Nissan Intelligent Mobility.” According to the guide at the booth, there are no general plans to adopt aluminum body panels for the concept car, with the exception of the hood. Due to the need for a deep three-dimensional design for the back door, carbon fiber is used.



Figure 2. Nissan's Ariya is an electric crossover family car.

Use of aluminum body panels for exterior materials is actively being promoted for high-end cars and sports cars for which costs are not an issue. However, adoption for use in family cars remains a challenge. In the long-term, lightweight features for EVs are essential and aluminum is an option along with carbon fiber. The company is not particular about one type of material, but is considering the overall management of the entire vehicle. Aluminum use for materials other than for the exterior appears promising.

Mitsubishi MI-TECH: The small-sized electric SUV concept car, MI-TECH, had its world premier at the show (Figure 3). The plug-in hybrid electric vehicle (PHEV) can traverse all-terrain and features a lightweight drive train, electric 4WD, advanced driver assist, and preventive safety technologies all packed into the compact SUV. This concept car embodies the Mitsubishi Materials Corporation brand statement, “Drive your ambition.”

According to personnel at the booth, there are unfortunately no plans for introducing aluminum body panels to this concept car. Since two years ago, the square features typical of Mitsubishi have been enhanced. It was determined that the design, which requires a fusion of hardness and softness, could not be expressed by the formability of aluminum. Weight reduction is achieved through the use of other materials. For example carbon fiber is being used for the fenders for both decorative purposes and lighter weight.



Figure 3. Mitsubishi's MI-TECH roofless concept car.

It appears that Mitsubishi has launched a perceived quality (PQ) team in the company to pursue satisfaction not only by the outer appearance, but also through the various senses such as touch. As such, the adoption criteria of different materials has become stricter. For example, if the hood is made from aluminum, the sense of incompatibility with regard to the fenders and roof must be eliminated. In addition, due to the difference in the bend radius between aluminum and steel, if the design is adapted to aluminum, which has a larger bend radius, the entire shape will become blurred and lose the original sharpness, thereby posing challenges. In recent times, demand for aluminum body panels from the design team has apparently decreased.

Moreover, another negative factor pointed out by designers is the high cost. Mitsubishi has a long history of use of aluminum outer panels with the Lancer Evolution (hood, roof) and the Outlander (hood). However, due to the reasons stated, adoption of aluminum exterior materials is not increasing. In this regard, future developments for use of aluminum are seen to be one option among various materials.

Honda Fit: At the Honda booth, the all-new Fit also premiered. The fourth-generation Fit comes in five different types, Basic, Home, Ness, Crosstar, and Luxe, which can be selected according to one's lifestyle or stage of life.

Aluminum body panels are not planned for the new Fit. The high cost incurred for aluminum is not feasible to achieve family car prices. Demand for lightweight features as a characteristic for family cars is not a high priority as compared to sports cars. In order to be competitive with other brand cars of the same level and price range, it is necessary to keep costs down, thus aluminum body panels were not adopted. Use of aluminum has not been progressing other than for the NSX.

In the future, Honda's policy is to achieve lightweight features not only through aluminum exterior panels, but also by making cost comparisons and considering the overall balance. There are many high-strength carbon fiber composites available, making it a major option along with aluminum.

Aluminum Auto Parts

In addition to new cars, the Tokyo Motor Show also presented developments in the use of aluminum materials for lightweighting in the automotive parts sector. Some examples follow.

NHK Spring now uses aluminum for lightweighting its rear seat frame (Figure 4). For over 40 years, NHK Spring

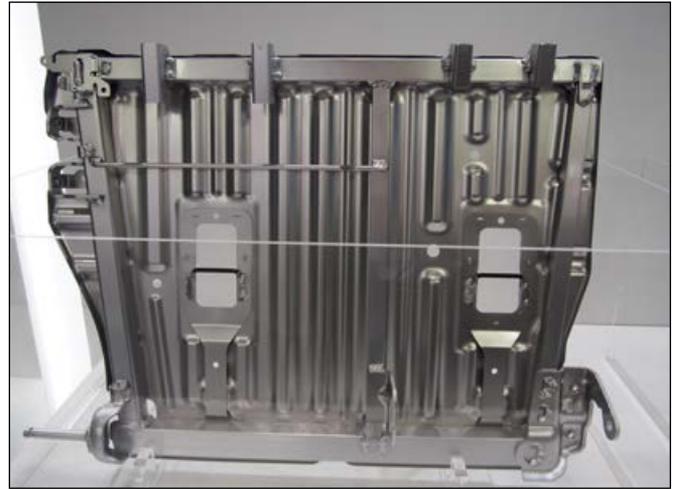


Figure 4. NHK Spring uses aluminum in its rear seat frame.

has supplied steel seat frames to various automobile manufacturers. Now they have developed an all-aluminum lightweight collapsible rear seat frame, with 7000 series alloy being used for the pipe and 5000 series for the bracket and back panels. A 30-35% weight reduction has been achieved compared to steel frames with the same level of safety. The frame for the front seat is currently being developed.

Akebono Brake Industry revealed a newly structured brake caliper (Figure 5). The brake caliper is a revolutionary product with its mix of light weight with high rigidity—realized thanks to its aluminum support bracket and its brand new structure connecting cylinder and support. In addition, because it can be seen through the gap between the aluminum wheel, the caliper is designed with a large surface, which allows for a sophisticated design. Moreover, the taper wear has been reduced to one-fifth of existing products. The caliper also produces less noise with a stable braking effect. The development of this product also takes into consideration adaptability to different automobiles.



Figure 5. Akebono Brake offers a new aluminum brake caliper.

Demand Trends for AI in Japan's Auto Industry

According to the statistics from the Japan Automobile Manufacturers Association, the country's automobile production, for the most part, is maintaining a steady pace (Table I). Production of passenger cars in the first half of fiscal 2019 (January-June) increased 2.2% year-on-year and is on an upward trend.

	Passenger Cars	Trucks	Buses	Total
2016	7,874	1,201	130	9,205
2017	8,348	1,220	123	9,691
2018	8,359	1,257	113	9,730
Y-on-Y Chg (%)	100.13	103.06	91.95	100.4

Table I. Japan's total auto production in thousands of vehicles. (Source: Japan Automobile Manufacturers Association.)

Approximately 27% of Japan's passenger car production is occupied by exports to the U.S. Thus, maintaining U.S. exports is a vital issue for Japan's automobile production. It was extremely fortunate that, in accordance with the trade agreement between Japan and the U.S., which was concluded in September, Japan was excluded from the target of additional tariffs to automobiles bound for the U.S.

The demand trend for Japan's aluminum products to the automotive sector is shown in Table II. There is no change in the structure in which approximately 78% of aluminum product demand for the automobile sector is occupied by casting and die-casting products, but the steady growth in rolled products is noteworthy. Due to trade friction between the U.S. and China, the sluggish

demand for rolled aluminum products in Japan is significant. However, demand from the automotive sector is steady with a 10.3% growth during the six-month period from January-June 2019. Incidentally, total shipments of rolled aluminum products for this period were down 5.4% from the same period a year earlier. The increase is mainly attributed to the growth in the use of aluminum for body and panel sheet. Unfortunately, we are unable to accurately grasp the volume of body panels statistically.

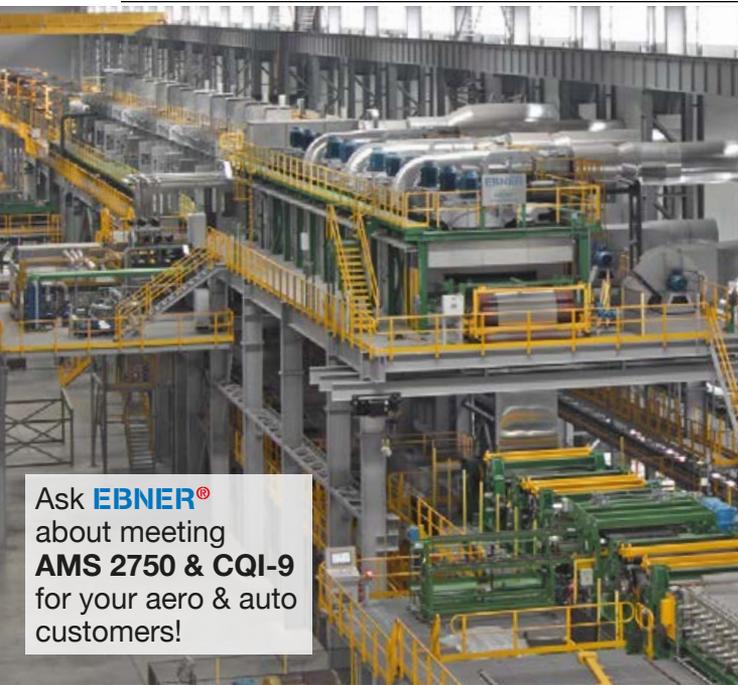
Meanwhile, major Japanese aluminum rolling manufacturers UACJ and Kobe Steel are both set to launch their new auto body panel lines in Japan in 2020. UACJ is adding new facilities at their Fukui Works for manufacturing automotive body sheet and materials, supplementing production of these products that are already handled by their Nagoya Works, which also manufactures heat exchanger materials. The new operations will bring their production capacity in Japan to approximately 100,000 tons.

Kobe Steel, Ltd. plans to increase heat treatment and surface treatment capacity at its Moka Plant in Moka, Tochigi Prefecture, Japan. The new equipment will provide 100,000 tpy of aluminum sheet for the Japanese automotive industry, once it starts production in early 2020. The company expects automotive demand for aluminum panels in Japan and other Asian countries to grow by approximately 10,000 tpy, increasing to over 300,000 tons in 2025.

Despite the challenges that have prevented some Japanese car manufacturers from implementing aluminum for body panels in their vehicles, the overall use of aluminum for body panels is moving along smoothly. However, it is expected that in the future, competition with other materials will intensify. ■

		2016	2017	2018	Y-on-Y Chg (%)
Rolled and Extruded Products	Wheels	1,261	1,212	955	78.8
	Motorcycles	6,717	8,162	7,651	93.7
	Passenger Cars	130,225	138,830	146,061	105.2
	Track & Buses	41,840	45,134	42,305	93.7
	Heat Exchangers	119,432	123,452	125,477	101.6
	<i>Sub-total</i>	<i>299,475</i>	<i>316,790</i>	<i>322,449</i>	<i>101.8</i>
	Rolled	-161,992	-171,401	-180,336	105.2
	Extruded	-137,483	-145,389	-142,113	97.7
Castings & Die Castings	Castings	396,178	412,982	424,382	102.8
	Die Castings	25,810	27,609	26,324	95.3
	Motorcycles	860,549	909,322	940,633	103.4
	Passenger Cars etc.	860,549	909,322	940,633	103.4
	<i>Sub-total</i>	<i>1,282,537</i>	<i>1,349,913</i>	<i>1,391,339</i>	<i>103.1</i>
Forgings		29,842	31,431	32,142	102.3
Total		1,611,854	1,698,134	1,745,930	102.8

Table II. Shipments of aluminum products for automobile and motorcycle applications. (Source: Japan Automobile Manufacturers Association.)



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