

# Aluminum Advances at the 35<sup>th</sup> Tokyo Motor Show

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The 35<sup>th</sup> Tokyo Motor Show took place from October 24 to November 7, 2001. Featuring 273 companies and 6 governments from 13 countries, the show attracted some 1.3 million visitors. As for passenger cars, 10 Japanese and 27 overseas automakers exhibited their latest models. This year, the show did not include its normally festive mood due to the aftereffect of the terrorist attacks in the U.S. in September.

To meet mounting requirements to make lighter automobiles as environmental controls become more strict, automakers appear to be advancing their work steadily to increase use of aluminum. Introduced here are mainly Japanese cars that were displayed that attracted attention from the viewpoint of aluminum usage.

Toyota Motor Corp. exhibited ES<sup>3</sup>, the Eco Spirit Cubic, a concept car that drew most of the attendees' attention (Figure 1). By using aluminum and plastics in various parts, Toyota succeeded in reducing the vehicle weight to 700kg and body to 140kg. ES<sup>3</sup> has a spaceframe structure comprised of extruded aluminum sections, die castings, and body sheet. Its doors, hood, and roof are made of aluminum sheet, and the lower arm in the suspension also uses aluminum. Aluminum content of the car amounted to about 100kg. Another noteworthy aspect of the car's construction is that the front and rear fenders and side sills are made of plastic to achieve further weight reduction.



Figure 1. The Toyota's ES<sup>3</sup>, the Eco Spirit Cubic.

These weight-saving measures have resulted in significantly improved fuel efficiency of the car at 47km per liter. According to life cycle assessment, CO<sub>2</sub> emission has been reduced by 32% compared to conventional vehicles.

Daihatsu Motor Co., an automaker in the Toyota group, introduced a small concept car called Ultra Fuel Economy (UFE), as shown in Figure 2. The automaker



Figure 2. The Daihatsu small concept car, UFE, Ultra Fuel Economy.

used an aluminum body and produced a car with a vehicle weight of 630kg and a 55km per liter fuel efficiency. Aluminum has also been employed in other parts of the car, such as the brake system and seat frames.

Suzuki Motor Corp., with its ample expertise in motorcycle production technology, had on display the GSX-R/4, which has a lightweight highly rigid aluminum frame (Figure 3). GSX-R/4 is a sports car that uses plastic and carbon fiber in addition to aluminum. The car has a space-frame made of large sections without any covering on it, and its unique design attracted the visitors' attention.

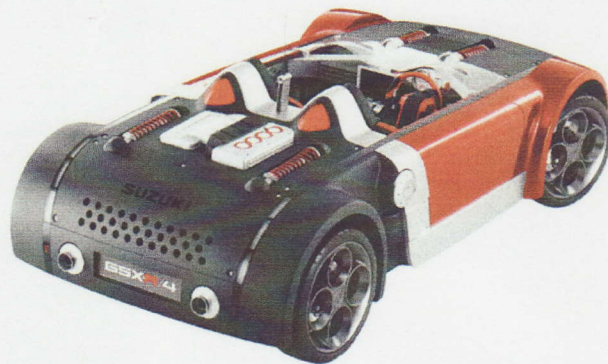


Figure 3. The Suzuki 6SX-R/4 sports car.

Honda Motor Co. exhibited the aluminum-truss framed UNIBOX, which drew attention of the visitors with its novel design. At the 1990 Motor Show, Honda introduced the all-aluminum body NSX and became the forerunner of aluminum use in automobiles. This time, Honda exhibited a new model, which used carbon fiber for the engine compartment cover and rear spoiler to further reduce weight.

Nissan Motor Co. displayed a concept car called Ideo (Figure 4), setting its eyes on a car ten years in the future, and partially used aluminum extrusions for the roof and front fender.



Figure 4. Nissan's Ideo.

## *Bioplastic Fantastic*

As it has been described so far in this article, Japanese automakers are making steady progress in using aluminum in automobiles. At the same time, they are increasingly taking up plastic and carbon fiber as lightweight materials.

Toyota has developed biodegradable plastics from sweet potato starch and other plant materials for making vehicle components. This bioplastic material is claimed to be



highly reliable and can be disposed of without harming the environment.

Like the Japanese firms, automakers from abroad displayed cars employing plastic and carbon fiber in addition to aluminum. Peugeot adopted an aluminum engine hood and plastic front fender for the three models of its 307 series. DaimlerChrysler chose carbon fiber as the body sheet for the aluminum spaceframe of the S600L. Peugeot deserves a high rating for applying aluminum in its popular models for the first time. In addition, BMW showed a sports car named Z8, and Ferrari displayed the sports-type car, 360 Modena F1, both of which are described as all-aluminum vehicles.

#### Aluminum Making Progress

It appears that European automakers are using more aluminum in auto structures and closures than the Japanese. However, since Mazda Motor Corp. selected aluminum sheet for the hood of the RX-7 in 1985, other Japanese automakers have adopted aluminum sheet in 31 models. As of 2001, aluminum sheet is used in 23 Japanese car models. Of these models, eleven adopted aluminum in the last three years, with one taking it up in 1999, four in 2000, and six in 2001. These figures indicate that use of aluminum is rising very rapidly.

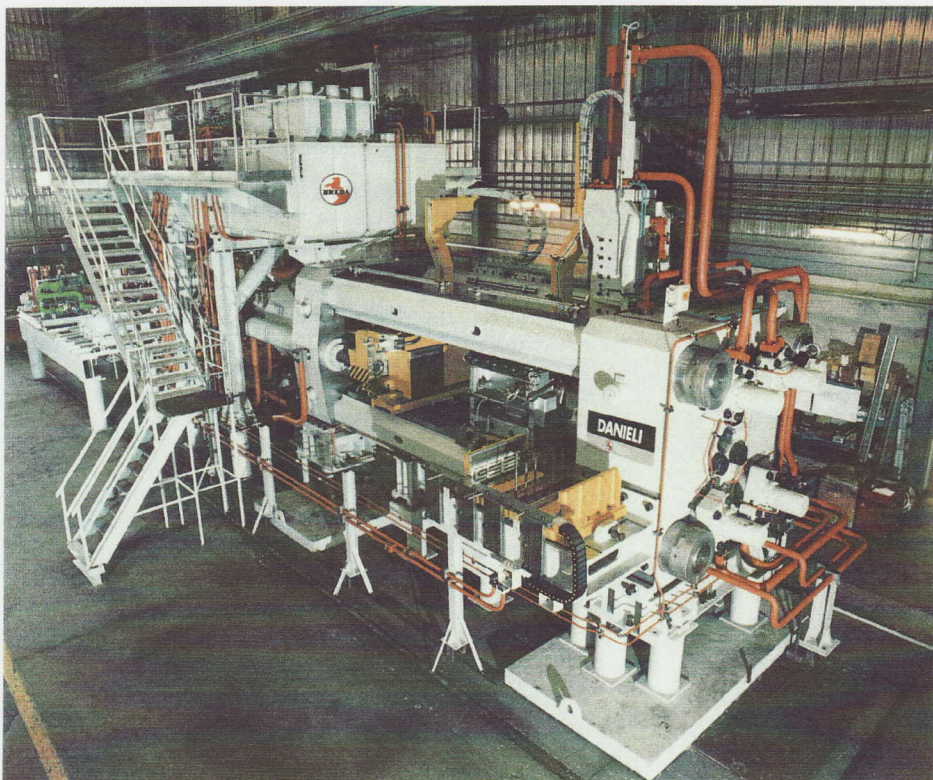
Aluminum usage in automobiles, including motorcycles, totaled 1.26 million tons in fiscal 2000 in Japan (Table I). This shows that consumption is growing firmly. Castings and die castings account for more than 80% of the total consumption, but demand for wrought materials is also growing at a rate higher than the average rate of increase for all products. In 2001 aluminum demand from the auto industry has been steady.

As can be seen from the cars exhibited at the latest show, automakers are diversifying the materials they are

using to make lightweight cars and are increasingly turning to plastic and carbon fiber. Furthermore, steelmakers are developing thinner sheets of 150kg ultra high tensile strength, adding variety to lightweight materials. Trends show that the use of aluminum is making progress in the auto industry. However, to promote the application of the material to a higher level, processing technology and the materials themselves need to be improved. In addition, cost of aluminum materials needs to be reduced.

		FY 1998	FY 1999	FY 2000	(tons) '00/'99 (%)
Motorcycle	Rolled	1,765	2,197	2,599	118.3
	Extruded	7,812	9,005	10,387	115.3
Passenger Car	Rolled	10,048	14,028	17,290	123.3
	Extruded	32,630	35,360	37,984	107.4
Truck & Bus	Rolled	9,105	10,039	10,529	104.9
	Extruded	17,005	18,592	20,098	108.1
Heat Exchanger	Rolled	67,732	67,841	73,162	107.8
	Extruded	41,542	43,250	44,831	103.7
Wheel	Rolled	6,154	7,164	8,505	118.7
	Extruded	108	88	95	108.0
Subtotal	Rolled	94,804	101,269	112,085	110.7
	Extruded	99,097	106,295	113,395	106.7
Castings		338,314	367,342	367,720	100.1
Die castings	Motorcycle	44,303	45,601	44,937	98.5
	Passenger Car	515,617	555,834	603,784	108.6
Subtotal		898,234	16,364	18,275	111.7
Aluminum Product Total		1,105,806	1,192,705	1,260,196	105.7

Table I. Semifabricated aluminum use for Japanese vehicles and some parts.



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