

# Light-Weight Mobility Can Change the World

## The 42<sup>nd</sup> Tokyo Motor Show

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The 42<sup>nd</sup> Tokyo Motor Show took place at the Tokyo Big Sight international exhibition center from November 30 to December 11, 2011. The previous show, held in the fall of 2009, was not carried out on a large scale, with only a few overseas manufacturers taking part, due to the slowdown in the global economy in the wake of the Lehman Brothers Holdings Inc.'s bankruptcy in 2008 (known as the Lehman shock) and growing interest in the steeply expanding Chinese auto market.

However, the 42<sup>nd</sup> show was successful with 14 domestic automakers and 21 overseas manufacturers, mainly from Europe, participating and displaying a large number of cutting-edge products and technologies. Included were 53 vehicles that debuted at the show. The number of visitors totaled nearly 850,000. Japan is recovering from mixed national crises caused by the Great East Japan Earthquake of March 2011 and it can be recognized that the show delivered the message to the country and abroad that the “the nation’s craftsmanship” is still strong.

“Mobility can change the world” was the theme put up by the organizer, Japan Automobile Manufacturers Association, conveying the message that vehicles are more than a means of transportation; they offer solutions to various global issues related to environment, safety, and energy. Instead of focusing on materials and development of technologies separately, the association put the connection between vehicles and society in the future at the fore. It can be appreciated from this that weight reduction of materials and downsizing of cars have already been factored in and lie at the undercurrent of car making.

On light-weight materials, use of high-tensile steel, aluminum, fiber materials, and reinforced plastic has increased steadily. On the vehicles themselves, the rapid increase in the number of plug-in hybrid vehicles (PHV), which follow the trend set by the electric vehicles (EV) displayed at the 2009 motor show, attracted attention.

### *Noteworthy Vehicles on Display*

PHV differs from the existing hybrid vehicle; a direct charge method is used for the vehicle by inserting a plug to an outlet. It has more batteries mounted on it and presents a strong feature of being an electric vehicle. For short distance drives, it can run on an electric motor only and can be used as an EV.

Toyota Motor Corp. announced that it would put on sale its Prius PHV on January 30, 2012 (Figure 1). This model is based on the Prius HV, which has been its highest selling car in Japan for 11 consecutive years. The time required to charge the Prius PHV is 1.5 hours at 200 v and 3 hours at 100 v. It has a driving range of 26.4 km after a charge and can travel at a maximum speed of 100 km. At first Toyota Motor used a steel case for the lithium-ion batteries for the experimental vehicle but later switched it to aluminum and was able to halve the battery case weight to 80 kg from 160 kg.

The model has lithium-ion batteries manufactured by Sanyo Electric Co., now a wholly owned subsidiary of Panasonic Corp. The company has a strong presence in this



Figure 1. Toyota's Prius PHV.

area as experimental PHVs displayed at the show by European carmakers such as Peugeot, Porsche, BMW, Audi, and Volkswagen all had Sanyo-Electric-made lithium-ion batteries mounted on them.

Honda Motor Co. has so far been promoting diversified development of HV technology. The company's AC-X, a PHV based on its Insight model, was on display at the show (Figure 2). The model has a driving range of 50 km on an EV mode. Honda has already disclosed that it will begin manufacturing its future key model PHV, based on the Accord, in the U.S. in 2012.



Figure 2. Honda's AC-X.

EVs debuted at the previous motor show as the main exhibit. Two years since the last show, the vehicle has steadily penetrated the market. Nissan Motor Co. exhibited two concept cars: the Nismo Concept, which is a sports car modeled after its Leaf EV, and the Pivo 3 (Figure 3), which aims to integrate itself with the cities of the future. The Pivo 3 has the features of a compact body, less than 3 m in length, and a comfortable three-seat interior. After the occupants get out of the vehicle, it can drive automatically and park itself without driver assistance. While parked, the PIVO 3 will automatically recharge itself. The driver can also call the vehicle from their smartphone, and the car will drive itself to the owner.



Figure 3. Nissan's Pivo 3.



Figure 4: Mitsubishi's PX-MiEV.

Mitsubishi Motors Corp. showcased its concept car PX-MiEV II (Figure 4). The company applied the know-how it had built up from developing i-MiEV in producing this concept model. PX-MiEV II is basically an EV that can travel with only an electric motor. But its system can start the engine when the vehicle is accelerating or when it is in high-speed mode to produce optimum driving force. The company's target is to develop a model that has a driving range of more than 50 km the an electric motor alone and cruising range of more than 800 km when the overall system of electric motor and engine is used. Fuel consumption of 60 km per liter is also another target for the model.

Another car that attracted attention was Nissan's Fuga HV. Nissan Motor used aluminum for the hood, doors, and suspension arms instead of steel and reduced car weight by 38 kg. There was also Toyota's Aqua HV, a model slightly smaller than Prius, which went on sale in December 2011. The Aqua HV achieved fuel efficiency of 35.4 km per liter, which is one of the highest fuel efficiency rates in the world.

Other automakers, such as Fuji Heavy Industries Ltd., Mazda Motor Corp., Suzuki Motor Corp., and Daihatsu Motor Co. strongly emphasized a stance that they are developing more eco-friendly EVs and HVs.

#### *Demand Trends of Aluminum in Japan's Auto Industry*

Shipments of aluminum products to the auto sector account for almost 40% of Japan's total demand. Use of rolled and extruded aluminum components in passenger cars is rising steadily. However, the fact remains that castings and die castings account for almost 80% of aluminum materials used in the auto industry. This make-up has not changed much in recent years.

Demand from the auto industry dropped sharply in 2009 following the Lehman shock. It improved in 2010 and returned to a level of over 90% of what it had been

		2003	2008	2009	2010	2009/2010 (%)	
<b>Rolled and Extruded Products</b>	Wheels	7,916	3,800	1,915	2,438	127.3	
	Motorcycles	11,651	10,753	4,887	7,022	143.7	
	Passenger Cars	85,985	118,352	80,399	114,173	142.0	
	Track & Buses	35,809	29,042	17,007	26,216	154.1	
	Heat Exchangers	127,997	151,161	91,803	131,785	143.6	
	Sub-total	269,358	313,108	196,011	281,634	143.7	
		Rolled	(132,259)	(162,795)	(103,724)	(148,084)	142.8
	Extruded	(137,099)	(150,313)	(92,287)	(133,550)	144.7	
<b>Castings &amp; Die Castings</b>	Castings	384,167	380,427	269,952	361,804	134.0	
	Die Castings	Motorcycles	44,672	45,338	23,301	33,991	145.9
	Passenger Cars, etc.	689,074	895,229	639,010	824,203	129.0	
	Sub-total	1,117,913	1,320,992	932,263	1,219,998	130.9	
<b>Forgings</b>		26,454	33,024	22,543	30,165	133.8	
<b>Total</b>		1,413,725	1,667,124	1,150,817	1,531,797	133.1	

Table 1. Aluminum product shipments (in tons) for automobile applications in Japan (2003-2010).

in 2008. The Great East Japan Earthquake of March 11, 2011 disrupted the auto-parts supply chain and demand for aluminum products dropped again by a large 16% in the January-June period of 2011 compared to the same six months prior. But demand improved steadily after that and despite the negative effects of floods in Thailand on the 2011 second-half results, it has returned close to the previous-year levels since the fall of 2011.

Demand from the auto industry will most likely be forced to drop to about 1.4 million tons in 2011 because of the impact of decline since the spring of the same year after the earthquake hit. The expectation is that demand will pick up in 2012 and exceed 1.5 million tons recorded in 2010 (Table 1).

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