Baffle integrated type STS fuel Tank for PHEV

ISSF Member	POSCO
Developer	ILJIN Co. & POSCO
Field	automotive
Location	Republic of Korea, Europe
Environment	urban
Grade and surface	304XD and 2B
Competing materials	Engineering plastic

Advantage points of using stainless steel

Austenitic stainless steel with improved draw-ability was used to the new concept fuel tank. This ensured equivalent performance (pressure/vacuum fatigue and radiation noise in fuel sloshing) while maintaining a similar weight to the plastic fuel tank. Therefore, it is possible to manufacture new stainless steel fuel tank with excellent price competitiveness.

Product description

Recently, the environmental problems caused by the accumulation of microplastics have become a serious social problem. Microplastics enter the ocean, acting as endocrine disruptors in marine organisms, disrupting ecosystems, and eventually reaching a greater risk for humanity, the end of the food chain. Therefore, activities are needed to reduce the use of plastics or replace them with eco-friendly materials.
Fuel tank is a representative plastic product among automotive parts. Replacing these plastic fuel tanks with recyclable stainless steel can help with environmental issues. PHEVs (Plug in Hybrid Electric Vehicle) have a longer fuel recharging period. So, the pressure by fuel gas vapor in the fuel tank is higher than that of ICEV (Internal Combustion Engine Vehicle). Therefore, the structural rigidity of fuel tank must be enhanced. And additional barriers are needed to meet evaporative gas regulations. These causes the price of the plastic fuel tank to rise. However, using stainless steels, it is possible to reduce the manufacturing cost compared to plastic. In addition, it is easy to modify the design for enhancement

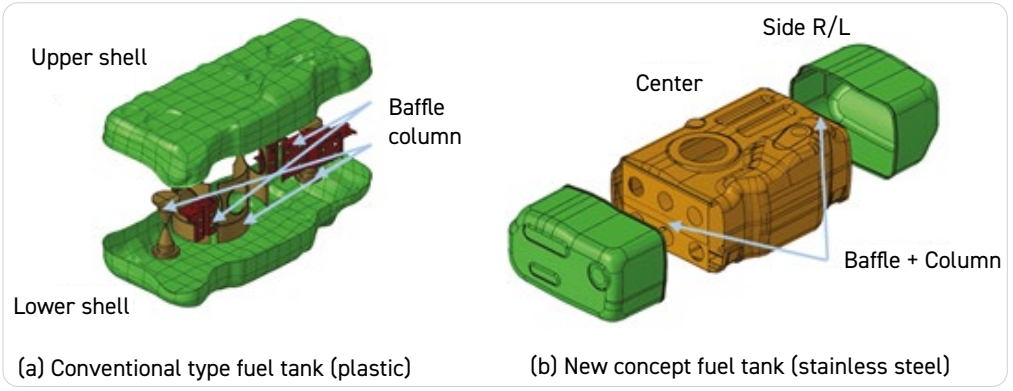

Figure 1 Comparison between conventional type and new concept fuel tank

of structural rigidity due to the excellent formability. These can be a big merit to automotive makers. Stainless steel fuel tank is used in some high-end PHEV, but more aggressive structural changes are needed to expand the market.
To this end, we propose a new fuel tank concept using STS304XD, newly developed stainless steel grade. STS304XD has superior draw-ability to a STS304 by adding Ni and Cu. The new fuel tank concept is divided into three parts to increase the degree of freedom in thickness for extremely lighter weight, and the baffles are manufactured as one of parts of the center part. In general, baffles are

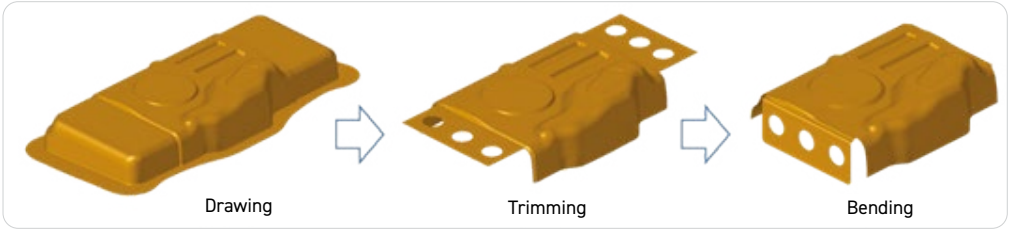

Figure 2 Manufacturing process of baffle integrated part

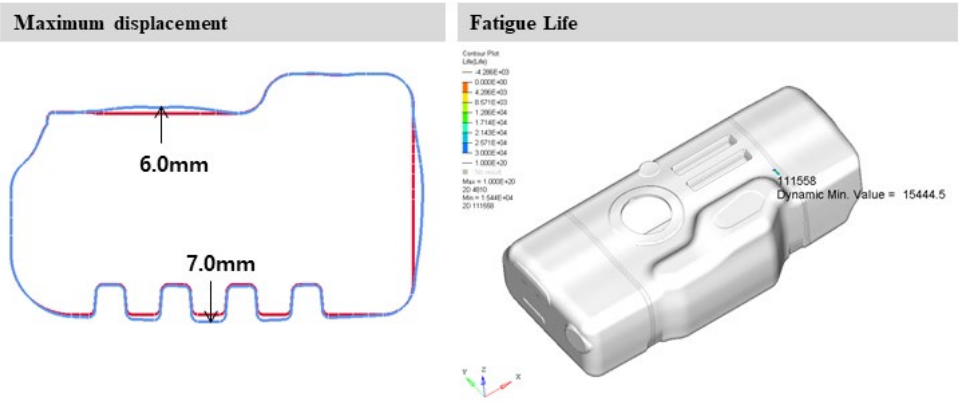

Figure 3 Simulation results of pressure/vacuum fatigue analysis.

installed in the forward / reverse direction of the car to reduce the flow noise, but the baffles in the proposed concept divide the space to decrease the volume of sloshing fuel. In addition the upper and lower baffles were welded to complement the structural rigidity.

The detail design was derived from design optimization process while maintaining performance similar to that of plastic fuel tanks, only 8% weight increase. We simulated the pressure/vacuum fatigue test and fuel sloshing test, which are the main performance indexes of the fuel tanks. Fatigue performance is important because fuel tanks, once installed, are used until scraping cars. And the radiation noise of the fuel tank is also an important performance evaluation index in PHEV

	Conventional Type	New Concept
Fuel level	3/4H	3/4H
Fuel K.E. (J)	79.9	86.4
Front surface Velocity (mm/ms)	1.800e-4	1.010e-4
SPL(dB)	62.0	57.8

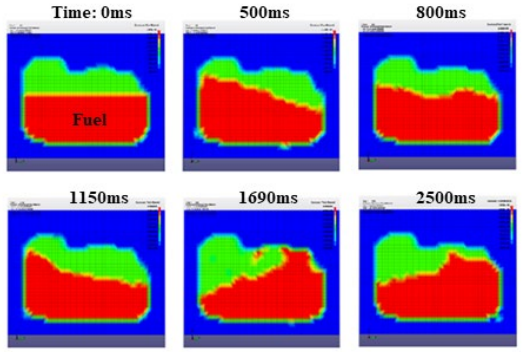

Figure 4 Simulation results of fuel sloshing analysis.

because the noise level of PHEV is reduced significantly.

The pressure/vacuum fatigue simulation resulted in a lifespan exceeding 30% of the performance standard, and the fuel sloshing simulation resulted in lower radiation noise approximately 5 dB compared to the plastic fuel tank. Based on the above results, it is expected that the proposed new fuel tank concept will be more suitable for PHEV.

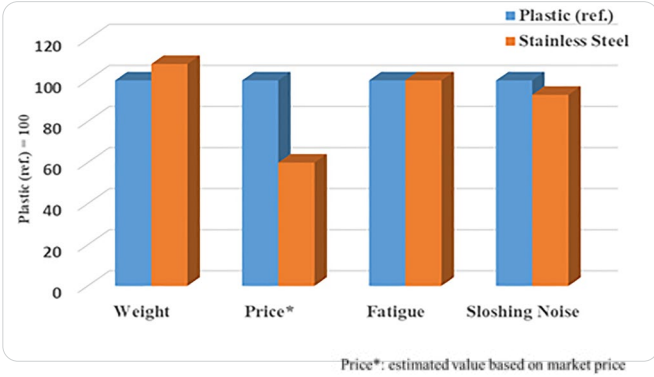

Figure 5 Comparison between plastic and stainless steel fuel tank.