

ALUMINUM: SAFE AND COST-EFFECTIVE WEIGHT REDUCTION



The aluminum industry projects that automotive aluminum use could more than double in next decade; building on the more than 40 years of uninterrupted growth. Aluminum solutions are part of a more holistic approach to designing and engineering cars and trucks, which includes lighter yet stronger materials, smart design, advanced powertrains and cleaner fuels. Aluminum offers the fastest, safest, most environmentally-friendly and cost-effective way to reduce weight and build a better vehicle.

SAFETY FIRST: REDUCING WEIGHT FOR IMPROVED FUEL ECONOMY AND LOWER EMISSIONS

Weight is the enemy of efficiency and that's why vehicle weight – not size – must be reduced significantly in concert with engine technology development and other advances to safely meet stricter government regulations. The Aluminum Association commissioned Dynamic Research, Inc. (DRI) to analyze the safety difference in a fleet of SUVs that vary by size and weight. Consider the facts:

- ▶ Designed to fold predictably during a crash, aluminum allows a vehicle to absorb most of the crash forces. Aluminum absorbs – pound for pound – two times the energy in a crash compared to steel and it offers greater weight reduction potential while retaining strength.
- ▶ Replacing iron and steel with aluminum creates a weight savings of 45 to 50 percent while increasing vehicle performance and fuel economy, without sacrificing safety.
- ▶ Unlike steel, aluminum can be used to maintain or even increase the size and strength of a vehicle's critical front- and back-end crumple zones without increasing overall weight.
- ▶ Aluminum improves performance creating lighter vehicles with higher structural stiffness allowing the vehicle to accelerate more quickly while providing better stability and response than heavier vehicles.

ALUMINUM'S WEIGHT REDUCTION POTENTIAL FAR EXCEEDS HIGH STRENGTH STEEL

Research by the European Aluminum Association shows that automotive aluminum offers greater weight reduction potential than steel while retaining strength. Findings include:

- ▶ In key automotive components aluminum can reduce vehicle weight safely by as much as 40 percent, compared to only 11 percent for high-strength steel.
- ▶ The reason the potential weight reduction using high-strength steel is so small, is that nearly 40 percent of the parts analyzed simply cannot be made thinner regardless of the grade of steel used. If high-strength steel were to be used to downweight these parts, their stiffness would actually be reduced and the car's performance would suffer, whereas, aluminum could be used without reducing stiffness or causing the car's performance to suffer.
- ▶ Combined with other data on the benefits of aluminum suggest a total of about 525 pounds of additional weight savings, which could result in 2.7 more miles per gallon or a nearly 10 percent further improvement in fuel economy over a typical auto today without sacrificing the vehicle's safety performance.



POCKETBOOK IMPACT: PART OF COST-EFFECTIVE SOLUTIONS

Cost concerns with regard to the use of lighter materials such as aluminum are a reoccurring theme in the debate over downweighting, despite the metal's four decades of uninterrupted growth confirming its cost-effectiveness and rising value proposition. And, while every improvement over the status quo has some associated costs (including high strength steels), aluminum is proven to complement other advances and helps offset their additional costs under some circumstances.

As automakers apply aluminum to reduce the weight of their vehicles, the focus is increasingly toward the system cost, which allows aluminum to compete successfully with other materials because of the advantages it brings in primary and secondary weight savings, fuel savings, structural performance and design flexibility. According to research conducted by the Aluminum Association with IBIS Associates, secondary cost savings can offset cost premiums helping make aluminum a more cost-effective solution. Consider the facts:

- ▶ A cost premium of \$630 is offset partially by a secondary cost savings of \$527 if the smaller driveline components are chosen, resulting in a total cost premium of only \$103. For every kilogram taken out of the structure, another 0.68 kilograms in secondary weight savings can be taken out as well.
- ▶ When taking a look at hybrid and electric vehicles, this benefit is magnified. The Aluminum Association, in conjunction with Ricardo, also conducted a study exploring the cost benefits of aluminum use in plug-in electric and hybrid vehicles. Aluminum use in electric vehicles can yield a savings of up to \$3,000 per vehicle. As more hybrid and plug-in electric vehicles come online, greater aluminum use can help lower overall costs to consumers since lighter vehicles will need fewer of the heavy, expensive batteries.