ULSAB and New Steels: Will they Preserve Steel's Automotive Market Share?

By Marsha Johnston, SBI Commissioning Editor

At first blush, the steel industry's newest incarnation of its Ultra-Light Steel Auto Body (ULSAB) project would appear to be a godsend for an industry so financially troubled and plagued by a reputation as a throwback to an antiquated Industrial Age.

Given the solid trend worldwide toward reducing car weight to improve fuel economy, ULSAB's new high-strength, ultra-light steels in its impressive package of redesigned auto body and avant-garde manufacturing techniques, is just what the steel industry's doctors ordered, right?

Yes, and it is clear that the new high-strength steels are well regarded and will be put to good use, although to what extent is open to debate in the industry. Sources interviewed for this article nonetheless agreed that steel is likely to remain an important, if not dominant, material, particularly for mass-produced cars. Says Bernhard Kleinermann, head of investor relations for steelmaker Salzgitter AG, in Salzgitter, Germany: "The high-strength steel grades have a growing market share, and not only in the automotive industry. There is no doubt for us that steel will be the material for mass-produced cars also in the future. The use of other materials is burdened with a variety of problems: Crash stability vs. weight, recyclability (especially with aluminium and composites), processability, costs (especially with magnesium and organic materials). The use of these materials will be limited mainly to prestigious niche cars."

Dr. Ulrich Schiefer, managing director of Porsche Engineering Group, which engineered the ULSAB design and manufacturing concepts, concurs. "There is no replacement when it comes to high-production cars, so I think cars 15-20 years from now will have lots of steel; and [advanced manufacturing] techniques, such as hydroforming and tailored blanks, will be employed."

Nonetheless, whether these advances will stave off an ultimate reduction in the steel industry's automotive revenues will depend largely on the following factors: Auto sales volumes, the stringency of legislative requirements for fuel economy, and improvements in the costs of manufacturing with alternative materials.

Worldwide, the automotive industry ranks second only to construction as the most important market to the steel industry. Car makers in North America, for example, currently account for approximately 25% of the steel produced in North America, and 17% in the UK.

Salzgitter's Kleinermann also notes that the auto industry accounts for 18% of its business.

Pete Peterson, director of automotive marketing for Pittsburgh, Penn.-based US Steel Corp., says that volume of business has grown. "It used to be, years ago, that a good automotive year was 12 million units and a bad one was 9 million. Two years ago, we hit 17 million, and what was a good year is now a reasonably low year and the upper boundary has been changed dramatically," he said.

The new steels are more expensive, which would certainly have translated into higher overall revenues if the new manufacturing techniques ULSAB has developed did not mean using smaller quantities of the material. Says Bill Hannen, president of the Steel Recycling Institute, "If we are totally successful [with ULSAB], we will lose business, as we will be shipping fewer tons of new steel, but we will have the same share of the vehicle." Adds Andy Sherman, Senior Staff Technical Specialist in Ford Motor Company's materials group and chairman of ULSAB's materials technology team: " You can't look at ULSAB auto components and say they will increase the volume [of the steel industry's auto business]. They may have a higher profit margin, but we will use less. The question is whether the net dollar value of their business will go up or down. But [ULSAB components] may keep applications [the steel industry] would otherwise lose." Thus, it remains to be seen whether higher car sales volumes will compensate for selling less of the higher-priced steels.

Quite possibly the greatest factor influencing just how many car manufacturing applications advanced steels will keep, at least in North America, will be the Corporate Average Fuel Economy (CAFE) required by law. The greater the fuel mileage the law demands, the lighter a car needs to be to achieve it. "As time goes on, it will be necessary to implement lighter weight concepts," Ford's Sherman explains. "Right now, we have increased the contents of vehicles to meet safety standards that increase the weight. In the future, increased pressure for better fuel economy and CO_2 reduction will be factors for…a continuing, increased pressure to decrease weight."

Indeed, evidence as to the importance of future CAFE standards is presented in the most recent version of the highly respected Delphi survey. The Delphi study is the result of the University of Michigan's Office for the Study of Automotive Transportation's extensive, confidential interrogation of the automotive industry's most widely renowned experts.

"The two-passenger car CAFE scenarios for 2009 present evidence that the [industry] panel expects [to achieve] mass reduction through materials substitution," says the study's executive summary;

- For a 30 mpg scenario, the panel forecasts low-carbon steel and cast iron to decrease by 10% and 12.5%, respectively, while aluminium and plastic are forecast to increase by 17.5% and 10%.
- For a 35 mpg CAFE in 2009, the panel forecasts low-carbon steel and cast iron to decrease by 15% and 20% respectively, while aluminium and plastic will increase by 35% and 20%.
- For light trucks in 2009, the panel forecasts a reduction of 15% and 20% for low-carbon steel and cast iron respectively, and an increase of 25% for aluminium and 12.5% for plastics.

"The automotive industry," the Delphi report explains, "continues to substitute lightweight materials for cast iron and steel in many engine applications. As components made from alternative materials approach manufacturing scale economies, these materials may more rapidly become the industry standard. The use of aluminium and plastic for exterior body components is expected to increase in the next decade, but steel is forecast to remain the dominant material."

Despite the panel's conclusion, there is a not-insignificant debate on how much weight the use of advanced steels will actually save, and thus how much it will be used. The ULSAB consortium tables at reducing the weight of a standard Taurus by between 25%-30%. Says US Steel's Peterson, "When we did our benchmarking against competitive structures of a standard Taurus, we found we could take out 26%. There were some vehicles where we took out as much as 36%, and some designs where we could only take out 16%." At an average of between 25%-30% weight reduction, he adds, ULSAB is really in a dead heat with the aluminium industry, whose claim of 40%-50% is "significantly overstated."

Porsche Engineering's Schiefer agrees with Peterson. "I think the 30% figure is realistic, although it depends on the base. If the car has already had weight reduction efforts, using carbon fibre components, for example, then for sure we wouldn't be lighter," he says.

The actual savings in total auto weight may be on the lower end of ULSAB's range, if the conclusions of MIT's Materials Systems Lab are any indication. Porsche asked the lab to conduct a cost analysis of the ULSAB body vs. one of traditional steel, based on a mid-sized vehicle, such as a Taurus. Says Joel Clark, professor of systems engineering at the Cambridge, Mass.-based Lab, "It's a set of new technologies that haven't been put into practice, so we're making assumptions. Our best analysis is that it probably won't cost any more [to implement] and will weigh 10%-20% less. ULSAB people say it will cost less, but we're uncomfortable with that, given the unproven nature of the technologies. If you can save that much weight with no extra cost penalty, it's a good deal."

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Indeed, one of the primary advantages of using advanced steel over using aluminium or composite materials, say some, is that it costs less to implement today. "The tool for forming steel is less expensive [and] the material is lower, the piece cost is cost-effective at over 100,000 units. The up-front, one-time investment is lower," says Porsche Engineering's Schiefer.

Adds MIT's Clark, "The reason [the new steels] won't cost any more to the auto industry, even though the steel industry is charging more, is because they can make thinner sections, and fabrication costs are less. It is more efficient, there is less waste. They can make the whole body side in one piece. It's kind of a win-win for steel and auto." Firoze Katrak, vice-president for business consulting at Boston-based Charles River Associates concurs: "The low cost cited by the steel industry for dropping in the new steels and their manufacturing techniques is about right."

Robert Culver, spokesman for the United States Council for Automotive Research (USCAR) recounts what happened when USCAR began the Partnership for a New Generation of Vehicles (PNGV) initiative, which has been replaced with the Freedom Car project. "We started working with aluminium technologies and the steel industry said it wanted to play too. When we reviewed [their proposal], the three auto companies said, 'These are more near-term, this is not long-term collaboration because the techniques for making and stamping steel are known. Whereas aluminium required a whole new way of processing things, they said they could go into plants with the steels tomorrow."

Ford's Sherman, however, does not agree: "ULSAB is not something you can drop into a current assembly plant. It's a departure, both in terms of materials and the way they are fashioned into parts and structures." USCAR's Culver also allowed that "some of the ULSAB technologies were not as inexpensive as they had been sold to us as being."

Despite some disagreement over how little the implementation of new steel manufacturing techniques would cost, there is little doubt that auto-grade aluminium cannot today compare with the cost of steel, even the high-strength steels. "If aluminium were at US$1 -US$1.10 per sheet, it would cost about the same as steel. It's now at about US$1.50-US$1.80. If you were to put aluminium in the newest rolling mills you can get the stock down to that price, but it's not car quality," says MIT's Clark. Says Ford's Sherman, a self-proclaimed proponent of aluminium in future cars: "The aluminium industry needs to think about whether the

automotive industry represents a large enough incremental business to maybe make changes in the way their commodity is priced." Aluminium prices are currently fixed by the London Metals Exchange. "I think there is some room to address the current price penalty of aluminium," he adds.

In fact, say the Delphi Study panellists, the cost of aluminium, as well as other "alternative" composite materials, and their processing, will be the most important material selection criteria in the coming decade. And they rated steel as having an advantage over other listed materials in the raw material costs, component processing and assembly stages of the vehicle life-cycle. Indeed, US Steel's Peterson is confident in his material's advantage on that point. "Automotive aluminium, on a per-pound basis, costs five times steel. On the assumption that you could take 40% of aluminium out, you're still trebling the cost of aluminium. Living in a world where an automaker will throw you out if they couldn't get a 5% reduction every year, with a 300% increase, they will not go there. They are caught in a cost-reduction squeeze and aluminium as a solution to cost reduction problems is expensive." Adds Porsche's Schiefer, "An important trend in the automotive industry is the life-cycle calculation of the car. You need energy to produce materials, build parts, to drive it and to recycle it. The production of steel is not very energy consuming and its recycling concept is an efficient one and can be done en masse. The recycling of aluminium is also easy, but you need lots of energy to produce it initially."

However, as most sources agree, the cost of aluminium and its use in manufacturing, as well as that of composite materials, will not remain high. Charles Rivers' Katrak says, "There is a slightly higher cost to implementing aluminium, but it is not as prohibitive as is being made out, and the cost of an aluminium sheet will come down. Ten years ago, an aluminium body would have been made of extrusions, castings, etc, and would have required massive changes. We see aluminium being used in the same mono-construction as steel."

Indeed, notes Ford's Sherman, "Aluminium use has gone up 2.5 to three times in the last 25 years, mostly in castings. It is beginning to make inroads in more and more stamped products, which directly displace steel. And it has been shown technically feasible to do aluminium body and there are some in production." The Delphi panel forecasts seem to bear out the aluminium advocate. Delphi panellists estimate that 95% of passenger car cylinder heads and 70% of cylinder blocks will be made from aluminium in 2009. Furthermore, the panellists say, although steel should continue to be the dominant material for body panels, aluminium is expected to see increased application for car bonnets (22.5%) and boot lids (17.5%).

In addition, "developments are underway to create low-cost graphite fibres, enabling advanced composite materials to compete economically with aluminium and steel," says Ford's Sherman. Meanwhile, magnesium is poised to take away applications from steel and aluminium. "Today, some cars have magnesium cross-beams – found in the back of the dash-board. It weighs half of steel components and is in production today, for an affordable cost," he said.

In the meantime, says Peterson, "The question is not how much [new steel] you're shipping, but what are the potential inroads of competitive materials to displace steel's future growth if [auto sales] continue to grow, or to impact the maintenance of steel's market share if auto sales remain flat."

Katrak, at Charles River Associates, says he believes the new steels "will help slow down the competition from other materials" but that roughly half of all new cars made in the US by 2015 will have aluminium bodies and half will have steel bodies.

"ULSAB has been successful in convincing the car companies that steel is not dead technologically and is a ready, viable competitor that is cost-effective. In that sense, ULSAB is effective, but people have unrealistic expectations of ULSAB, hoping that it will prevent any penetration of aluminium in car bodies, and that is just flat wrong. When we say that by 2015 we will have half aluminium and half steel, it does not mean that ULSAB has failed, rather that it has succeeded, because otherwise [aluminium penetration] would be greater." ■