Some Aspects of Materials Technology for Automotive Part Industry

by National Metal and Materials Technology Center (MTEC), NSTDA

***Figure** 1: Light-weight Composite Container for a Six-wheel Logistic Truck reduced more 50% weight from normal (courtesy of 'GRE COMPOSITES COMPANY LIMITED')*
***Figure** 2: Grip Assist Handle by using gas assisted injection molding process (courtesy of 'AMPAS Industries Co., Ltd.')*
***Figure** 3: Light weight A-pillar (courtesy of 'Thai Summit Group')*

In recent years there have been interesting developments in automotive part industry. Materials technology has played an important role in developing more efficient and yet reliable alternatives for the industry. World-leading vehicle makers have increasingly used alternative materials in a number of models, particularly high-performance cars. Alternative materials have been introduced to replace conventional ones in several parts and applications. Interesting replacements of materials for automotive parts may be shortlisted as follows:

- advanced high strength steel vs. conventional steel
- cast and wrought aluminum alloys vs. cast irons
- composite materials vs. metallic alloys
- bioplastic vs. petro-based plastic

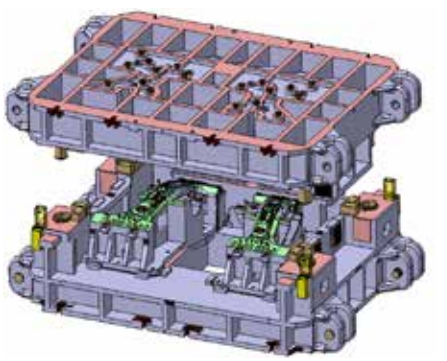
These material replacements are governed mainly by efforts toward improvement of fuel consumption and environmental friendliness. Designers and engineers in automotive industry have successfully made technological advancements addressing such efforts. Appropriate uses of alternative materials such as high strength steel, aluminum alloys, and composites help reduce vehicle weight resulting in improved efficiency. Environmentally, bioplastic is interesting as it represent green material.

Nevertheless, it should be noted that there are important aspects concerning the uses of such alternative materials. Generally, the advanced materials are relatively more expensive than their counterparts. In addition, for particular materials such as advanced high strength steel and composites, manufacturing processes can be more difficult and costlier. Principles and practices regarding part manufacturing are different to a greater or lesser extent. Particular differences are design and manufacture of mold and die, design of process conditions as well as operations pertaining thereto. Conceivably, automotive part suppliers who deal with these alternative materials have to acquire appropriate technologies and develop their capabilities accordingly. Or they may become uncompetitive.

MTEC, as a national materials technology center, has realized that it is very important to support local part suppliers so that they stay technologically competitive. MTEC researchers and engineers have conducted several series of collaborative and contract research and development with the suppliers. For example, an emphasis has been placed on die design and manufacturing process design for stamping of advanced high strength steel in order to overcome a troublesome problem called spring back. Concurrently, Cluster Program Management of NSTDA, under Manufacturing and Service Industry Cluster, has also run a technology acquisition program for local part makers.

The program has arranged oversea experts to participate in collaborative projects. There are three key parties in each project regarding material and its manufacturing process technology. These are an oversea expert, MTEC or Thai university researchers, and engineers assigned by the maker participated in each project. This technology acquisition program covers the following areas: forming process for advanced high strength; complex extrusion process for wrought aluminum alloy; advanced molding for plastic. An important goal is to strengthen Thai researchers and engineers as well as the local part makers in order to become technologically capable and competitive.

In addition to the contribution related to materials technology, MTEC and NSTDA have also promoted modern enabling tools in terms of digital engineering and manufacturing. These are, for instance, CAD/CAM/CAE, RP/RT, 3D Printing, automation and industry robot. Appropriate use of these modern tools can help shorten lead time in launching new products, improve product quality, and reduce product cost.



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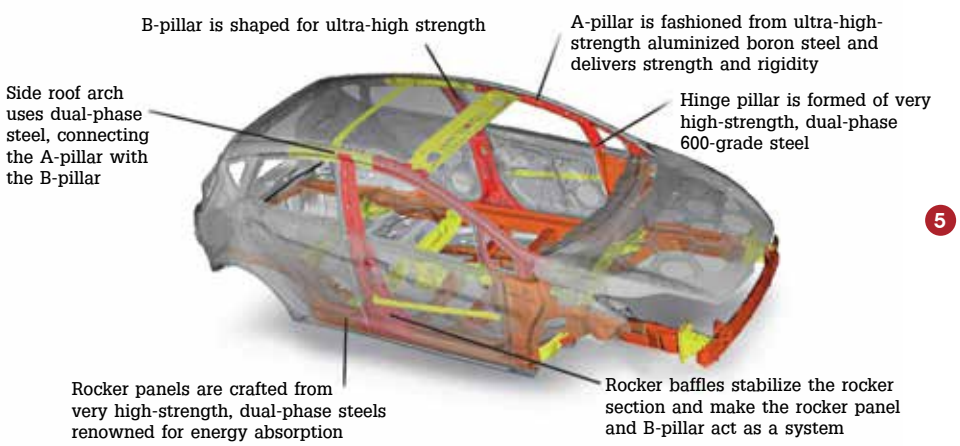

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Figure *4-5: Using Finite Element Method to design high-tensile steel forming*
(Figure 4 by courtesy of 'Thai Summit Group';
and Figure 5 refers to http://rundeautochat.com/2011/12/07/ford-working-the-steel-and-the-awards-show-they-are-masters/)