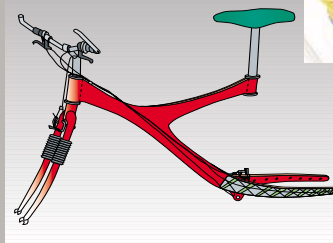
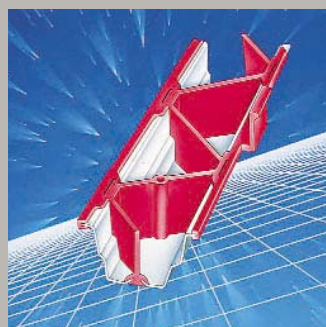
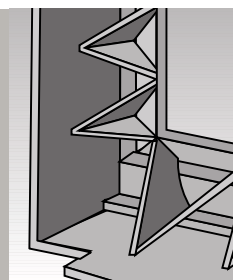


## PLASTIC/METAL HYBRID TECHNOLOGY

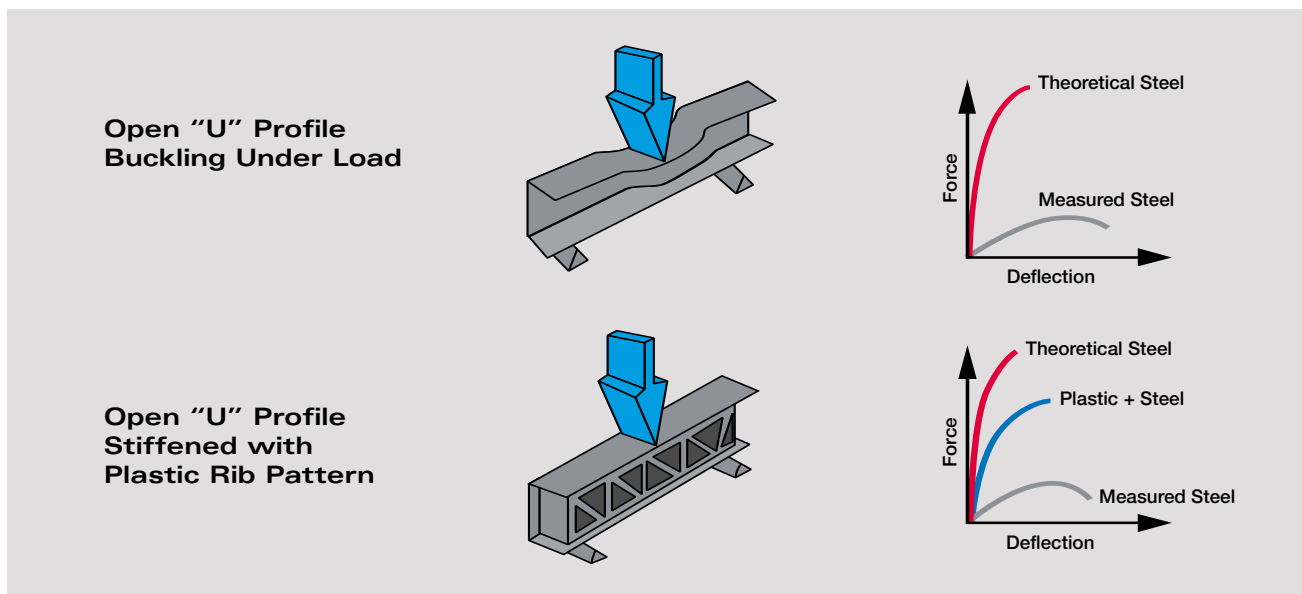
Innovative Design Solutions for Structural Performance  
with Weight and Cost Reduction



# LANXESS Corporation Unites Plastic and Metal to Help Manufacturers Create Products That Perform Better

## Until Now, the Only Way to Support Formed Sheet Metal Stampings Has Been to Use More Metal

Using thin-walled sheet metal in manufacturing confronts engineers and manufacturers with a serious drawback—geometric and dimensional stability decrease as sheet thickness decreases. As a result, unsupported metal is exposed to the risk of buckling before maximum stress tolerance is reached. Adding metal to the structure is one solution, but doing so adds additional material cost and weight to the product.



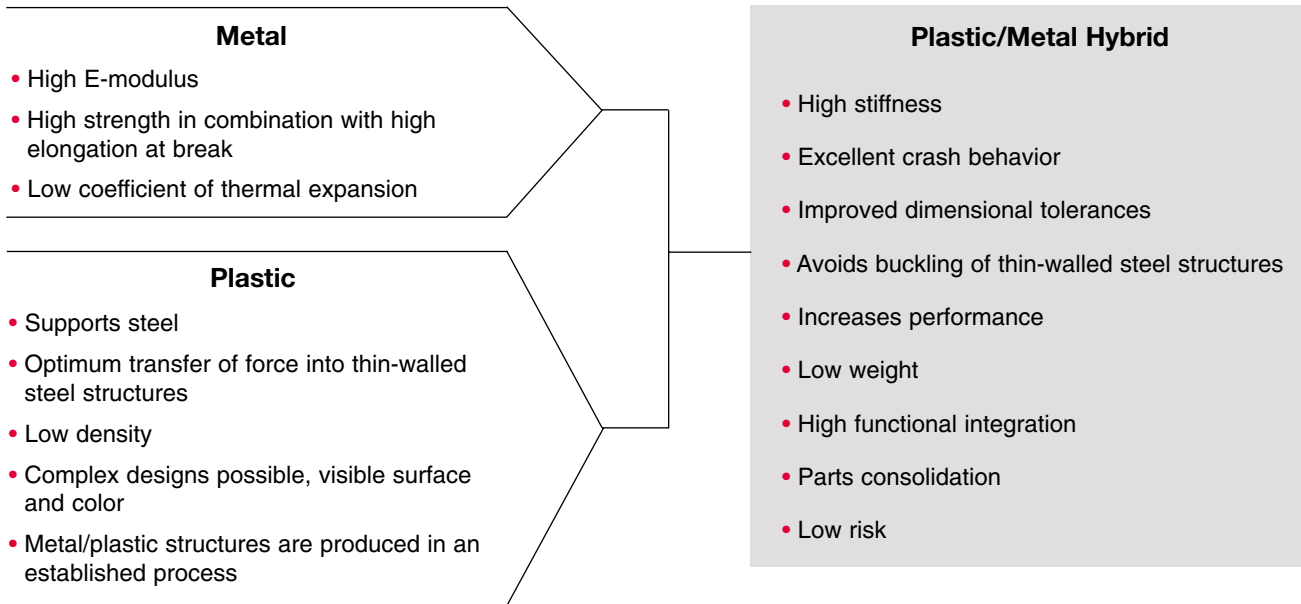
A thin, open, steel-only "U" profile buckles under load (top), while the same profile stiffened with plastic ribbing approaches the same load as theoretical steel by resisting early buckling (bottom).

## Introducing LANXESS Plastic/Metal Hybrid Technology

LANXESS Corporation has developed a better solution: Plastic/Metal Hybrid technology.

Plastic/Metal Hybrid parts consist of a thin formed sheet metal profile supported by ribbing made from LANXESS plastics. The metal provides required strength and stiffness, while the plastic ribbing provides the support necessary to prevent premature buckling without adding significant weight to the structure.

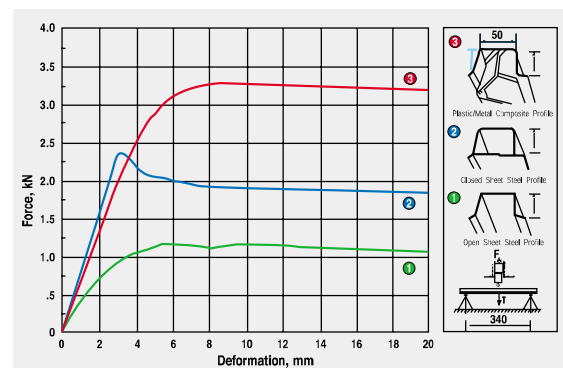
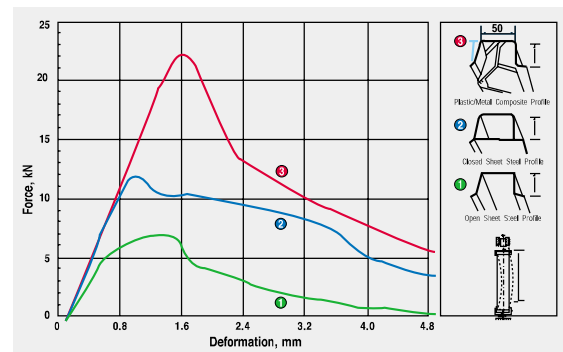
## LANXESS Plastic/Metal Hybrid Technology Advantages

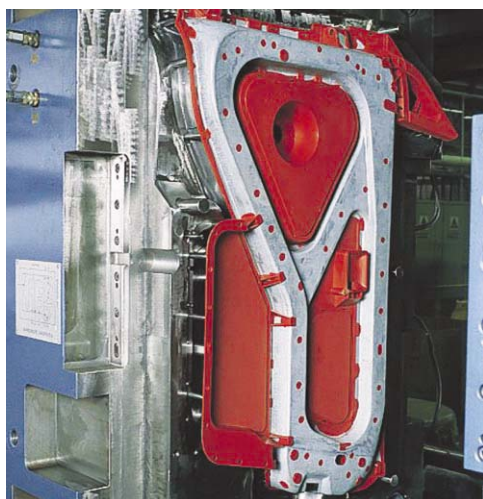


## Teaming Plastic with Metal Enhances the Performance of Each

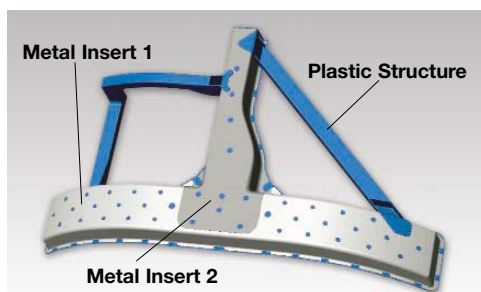
LANXESS Plastic/Metal Hybrid technology does more than optimize the performance of metal. The material synergy of plastic and metal gives products mechanical performance properties important to end users:

- Excellent resistance to bending, compression, and torsional loads
- High energy absorption
- Dimensional stability
- Low part weight





The injection molding process combines metal stamping with plastic structures, increasing design efficiency and reducing assembly steps, which can help reduce costs.



The in-mold assembly process joins different metal stampings together.



LANXESS Plastic/Metal Hybrid technology has been used in the front-end construction of the Ford Focus, yielding a 20 percent reduction in part costs, a 50 percent reduction in investment cost, and a 40 percent reduction in weight.

## Reduced Assembly Steps, Increased Design Efficiency, and More

To produce composite parts LANXESS Plastic/Metal Hybrid technology uses a standard injection molding process, where thermoplastic resin is overmolded onto metal stampings in an injection molding tool.

The technology allows metal to be located only in required areas, increasing design efficiency. Multiple steel stampings can also be joined together by specially designed buttons that transfer loading from one stamping directly to the next, eliminating the need for welding stampings together in a separate step. Reducing assembly steps can help reduce costs.

Plastic/Metal Hybrid structures provide other advantages as well:

- Extremely tight dimensional stability. The molding process supplies geometrically precise, warp-free parts that resist temperature and other environmental variables.
- Integration of functional elements. Incorporating plastic allows for the creation of ready-to-assemble modules, eliminating costly pre-/post-assembly and welding work.
- Easy recycling. A hammer mill and magnetic separator easily separate the steel and plastic components for reuse. Non-steel hybrids can be separated on a density differential basis.

Plastic/Metal Hybrid technology produces a structure with a mechanically interlocked connection between both materials—a single, unified component.

## Patented Plastic/Metal Hybrid Technology from LANXESS Corporation Is Proven in the Automotive Industry

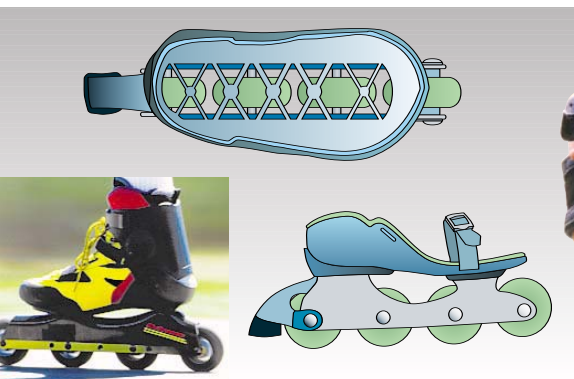
Plastic/Metal Hybrid technology was conceived in the late 1980s. Utilizing our expertise, General Motors developed a prototype instrument panel support structure. Today, automobile companies such as Audi, Ford, and Nissan use LANXESS Plastic/Metal Hybrid technology for the construction of parts ranging from front-end structures to seating and more. It provides strength, rigidity, and energy absorption with weight reduction for fuel efficiency.

LANXESS DURETHAN® polyamide is the current material of choice for Plastic/Metal Hybrid applications. DURETHAN® polyamide offers a combination of stiffness, high strength at varying temperatures, high strain at break, and increased impact resistance. By using metal with LANXESS DURETHAN® material, users save weight by reducing the amount of metal needed. At the same time, the Plastic/Metal Hybrid design helps to simplify assembly by consolidating separate components into a single molded part. Other polymers within the broad LANXESS product line can provide hybrid solutions, depending on application requirements.

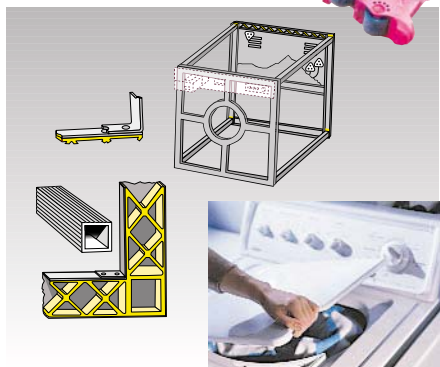


## This Versatile Technology Can Benefit a Variety of Applications

The higher degree of part consolidation and production efficiencies of the Plastic/Metal Hybrid process open new avenues for design, helping producers meet and exceed product performance demands. Here are just a few of the possibilities with Plastic/Metal Hybrid technology:



LANXESS Plastic/Metal Hybrid structures can provide the torsional stiffness and light-weight construction needed for in-line skates. Plus, they enable multifunctional integration together with economical production.



Appliances with Plastic/Metal Hybrid substructures offer lighter weight, reinforced housings as well as functional consolidation and cost-effective production.



Incorporating Plastic/Metal Hybrid technology into bicycle frames can improve stiffness and reduce weight. It also offers manufacturers a more versatile and cost-efficient concept with which to design and process.



A motor scooter frame can benefit from the lower production costs and multi-purpose design capabilities of Plastic/Metal Hybrid construction.

With Plastic/Metal Hybrid structures, large television housings can be stylishly designed yet economically manufactured. Hybrid construction also provides optimum torsional stiffness, multifunctionality, and innovative marketability.

## Features of Plastic/Metal Hybrid Technology Address Key Requirements of Various Applications

	Weight Reduction	Increased Strength	Improved Stiffness	Cost Reduction	Functional Integration	Modularity	Innovative Marketability	RF Shielding
Household Furniture	•			•	•	•	•	
Hand Tools	•		•	•	•		•	
Sports Footwear	•	•	•	•	•		•	
Home Appliances		•		•	•	•	•	
Agricultural Equipment		•	•	•	•	•	•	
TV Monitor Supports	•		•	•	•	•	•	
IT Cabinetry		•	•	•	•	•	•	
Aircraft Structures	•	•	•	•	•	•	•	
Office/Medical Furniture		•	•	•	•	•	•	
Recreational Vehicles	•		•	•	•	•	•	
Electronic Housings	•	•	•	•	•		•	•



## **LANXESS Corporation Will Help You Apply Our Technology to Your Idea**

LANXESS Corporation will work with you every step of the way to take your idea using our Plastic/Metal Hybrid technology from concept design to reality. The technical assistance we can provide includes:

- Feasibility studies to determine whether Plastic/Metal Hybrid technology is suitable for your application
- Concept development—how to start and move in the right direction
- Detailed design support
- Finite element analysis to optimize the design and performance of the part
- Mold filling calculation to ensure processability
- Injection mold design assistance to ensure proper placement of the metal insert in the mold

## **Find Out What LANXESS Plastic/Metal Hybrid Technology Can Do for You**

LANXESS Plastic/Metal Hybrid technology can deliver mechanical performance and cost advantages to a wide range of industrial and consumer product applications. It might be right for yours, too.

Call a LANXESS Corporation representative today at 1-800-LANXESS (1-800-526-9377) to learn more. See if our Plastic/Metal Hybrid technology can help you make cost-effective products that outlast and outperform those of your competitors.



With decades of experience and customers spread across the globe, LANXESS is already one of the world's major chemical manufacturers. LANXESS was formed in 2004 through the carve-out of major portions of the chemicals activities of the Bayer Group and parts of its polymers operations, which means it has many years of experience to look back on, with roots going all the way back to the founding of Bayer in 1863. This is the basis on which LANXESS now develops, produces and markets a portfolio consisting of basic and fine chemicals, color pigments, plastics, fibers, special-purpose rubbers, rubber chemicals, material protection and water treatment products and chemicals for the production of leather, textiles and paper. In so doing, LANXESS provides reliable solutions worldwide for a wide range of different applications.

The manner in which you use and the purpose to which you put and utilize our products, technical assistance and information (whether verbal, written or by way of production evaluations), including any suggested formulations and recommendations are beyond our control, therefore, it is imperative that you test our products, technical assistance and information to determine to your own satisfaction whether they are suitable for your intended uses and applications. This application-specific analysis must at least include testing to determine suitability from a technical as well as health, safety, and environmental standpoint. Such testing has not necessarily been done by us. Unless we otherwise agree in writing, all products are sold strictly pursuant to the terms of our standard conditions of sale. All information and technical assistance is given without warranty or guarantee and is subject to change without notice. It is expressly understood and agreed that you assume and hereby expressly release us from all liability, in tort, contract or otherwise, incurred in connection with the use of our products, technical assistance, and information. Any statement or recommendation not contained herein is unauthorized and shall not bind us. Nothing herein shall be construed as a recommendation to use any product in conflict with patents covering any material or its use. No license is implied or in fact granted under the claims of any patent.



# LANXESS

Energizing Chemistry

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