High-Strength Ductile Iron Control Arm Meets Lightweighting Objectives

Case Study: Ford CD4 Control Arm

Aluminum components are often utilized for their lightweight capabilities in the automotive industry. However, **Waupaca Foundry, in collaboration with Hitachi Metals America, successfully converted the Ford CD4 platform lower control arm from aluminum to high-strength ductile iron,** not only achieving weight and cost savings for the company but also relieving the company's supply chain that was facing disruption due to the high volume of production.

Situation

Ford Motor Company originally selected a 25.4 pound (11.5 kg) aluminum lower control arm for its CD4 platform. Although the aluminum component achieved the weight reduction goal, it resulted in a considerable cost increase when compared to ductile iron and caused continued stress to the company's supply chain.

After the initial launch of the aluminum component, Ford asked Hitachi Metals America to explore development of a lightweight ductile iron solution that could meet the company's weight reduction objectives as well as provide significant cost savings and stiffness capabilities over the current aluminum component.

However, the initial design concept for the new control arm showed a considerable gap in achieving weight reduction targets, and because of increased production demand, Ford required an intensely compressed component development schedule that would result in Waupaca Foundry having to launch the new product without the typical number of prototype phases.

Solution

Hitachi Metals design engineers designed a suspension component that exceeded performance and weight reduction targets, utilizing HNM® 500M high-strength ductile iron for its high ductility and toughness.

The final design was refined by more than 20 design iterations, and the team worked with Ford to ensure that mating part interfaces for the control arm were carefully detailed to enhance durability and proper assembly function.

Waupaca Foundry also collaborated with Ford to successfully expedite tooling construction and complete product validation within the compressed timeline, experiencing no significant issues or delays throughout the process. Tooling engineers utilized iron solidification software and other simulation tools for analysis to ensure a smooth and rapid startup of the new product, revealing the ideal balance between casting and machining productivity.

Overall, the high-strength ductile iron control arm was optimized to 19.2 pounds (8.7 kg), a weight reduction of 6.2 pounds (2.8 kg) from the aluminum component.

BEFORE:

Aluminum Ford CD4 Control Arm

AFTER:

Ductile Iron Ford CD4 Control Arm

- Ductile iron control arm has **30% higher stiffness** compared to the aluminum solution.
- Achieved **25% weight reduction** over the aluminum solution.
- Realized a **30% cost savings** per casting.

Win Win

Converting the control arm from aluminum to high-strength ductile iron enabled exceptional lightweighting and optimization for the component.

Through design and application of the high-strength iron alloy, Ford realized a **25% weight reduction** from 25.4 pounds (11.5 kg) to 19.2 pounds (8.7 kg), a 6.2-pound (2.8 kg) difference. In addition, Ford realized a **30% cost savings per part and received a 30% increase to the component's stiffness.**

Throughout the entire process, quality and process efficiency objectives were quickly achieved, and Ford's urgent need to increase production was fulfilled in time to meet demand.

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