Research Fund for Coal and Steel

TOP GEAR

Gears with top in-service performance developed for hybrid and electric vehicles

Deliverable D6.2 (D11)

Benefit provided by the alternative manufacturing routes

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Legal Disclaimer

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PUBLISHABLE SUMMARY

In the electric vehicle (EV) industry, there is a significant trend toward developing engines that can operate at higher revolutions per minute (RPM) ranges. This change is aimed at improving the performance, efficiency, and overall driving experience of the vehicle. In the field of automotive gear manufacturing, the choice of heat treatment is critical in defining final mechanical properties, dimensional stability, surface hardness, and fatigue resistance. The traditional LP-Carburizing treatment is compared with the new Nitriding heat treatment identified in the TOPGEAR project as the most promising to meet the high-speed requirements of future electric vehicles.

The proposed alternative process has been applied on a 42CrMoBi4 steel, a chromium-molybdenum alloy enhanced with bismuth to improve machinability. This steel is subjected to nitriding, a thermochemical surface treatment, leading to minimal geometric distortions due to its low process temperatures and the absence of a quenching step. This stability allows for finishing operations like grinding or hobbing to be performed prior to heat treatment. Consequently, post-treatment machining becomes unnecessary, affecting noticeably to the total production cost. A preliminary cost analysis showed a lower cost for the nitriding route than for the LP-carburizing route. Even though a more in-depth analysis is necessary, nitriding seems to be a potential economic and technical alternative to conventional carburizing for high-speed gears for EV transmissions.