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Scientific line:

New materials in forging

Title: Novel Bainitic Steel Grade Design and Its Closed-Die Forging as Front Axle Beam to Improve the Process Chain Focusing on Reduced CO2 Emissions and Sustainability

Company:

Author(s): Parsan and Asil Celik

Speaker: Prof. Dr. Arcan Dericioglu and Gürbüz Güzey

Prof. Dr. Arcan Dericioglu and Gürbüz Güzey

Gürbüz Güzey: Mechanical Engineer, MSc. Mechatronics
30 Years of experience in Forging and Metal Forming Business and Technology.
The current position is Engineering Director of Parsan and Omtas Companies as responsible of Engineering, Investments, R&D, New Projects, and Quality.
Prof. Dr. Arcan F. Dericioglu received his Ph.D from The University of Tokyo in Materials Science (2002) and had lectured and conducted research at various academic institutions in Japan and in USA. Currently, Dr. Dericioglu is a full professor at the Department of Metallurgical and Materials Engineering of the Middle East Technical University, Türkiye. Simultaneously, Dr. Dericioglu is leading the R&D department and projects of Asil Çelik, the largest quality steel producer of Türkiye. His active research topics are Heat Treatment and Phase Transformations, Additive Manufacturing (3D Printing) of Metallic Materials, Microwave Processing (Ceramics and Metals) and Electromagnetic Interference Shielding and Radar Absorbing Materials/Composites.

Abstract:

The increasing adoption of various non-ferrous alloys in a wide range of structural applications has not diminished the critical role of steel in industries such as automotive, aviation, and power generation. Steel remains indispensable due to its cost-effectiveness and versatile properties. However, reducing the carbon footprint across the entire steel production and component manufacturing process—from refining to finished products—has become a priority. Achieving this goal involves optimizing process efficiency, utilizing carbon-neutral raw materials and energy sources, and eliminating energy-intensive steps. Heat-treatable steels, widely used in engineering applications, contribute significantly to carbon emissions due to their energy-demanding final heat treatment step. Bainitic steels, on the other hand, offer a sustainable alternative by achieving comparable mechanical properties through controlled cooling at the end of the component production process, thereby eliminating the need for additional heat treatment.
This presentation introduces a novel low-carbon bainitic (LCB) steel grade developed by Asil Çelik, designed to address these challenges. This bainitic steel has been closed-die forged by Parsan as an front axle beam such that the properties required from the final component have been achieved by both compositional adjustments and controlled cooling following the thermo-mechanical shaping, as opposed to those achieved by additional heat treatments in case of heat-treatable steel grades with higher alloying content. Testing and analyses on the closed-die forged axle made from this bainitic grade demonstrate its suitability for demanding applications. This innovative steel grade coupled with proper and controlled component manufacturing offers streamlined process chain and reduced carbon emissions embracing a sustainable solution for the future of steel production and engineering applications.