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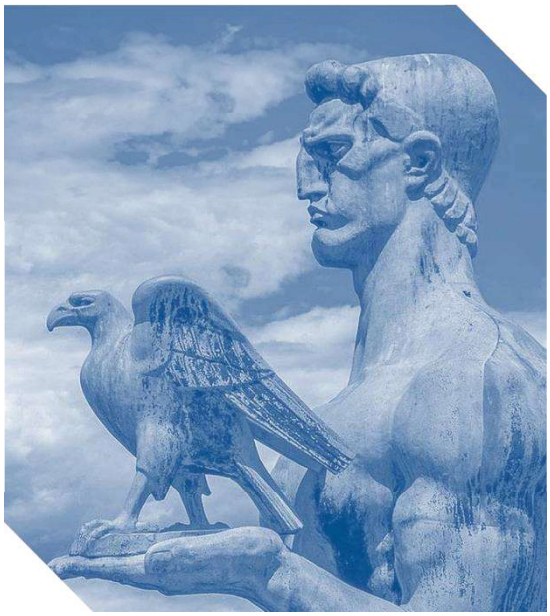

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Editors
SIMON SEDMAK
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Coordinator
Aleksandar Sedmak

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RESISTANCE TO FATIGUE CRACK INITIATION AND PROPAGATION IN HARDFACED LAYERS OF HOT-WORK TOOL STEELS

Dušan Arsić[1,*], Vukić Lazić[1], Djordje Ivković[1], Marko Delić[1], Aleksandra Arsić[2], Srdja Perković[3], Ljubica Radović[3]

[1]University of Kragujevac, Faculty of Engineering, Serbia
[2]University of Belgrade, Faculty of Mechanical Engineering, Serbia
[3]Military Technical Institute, Belgrade, Serbia
*corresponding author: dusan.arsic@fink.rs

Abstract

This study examines the feasibility of using welding as a repair method for damaged components in the forging industry. Critical parts in forging applications are typically made of high-quality hot work tool steels capable of withstanding rigorous impact loads and temperature shocks during operation. These include forging dies, ejectors, inserts, and similar components. Although these steels exhibit excellent mechanical properties, even at elevated temperatures, prolonged use leads to surface damage such as wear on die radii, cracks, or even metal spalling. The cracks that develop on the surface of forging tools are fatigue-induced, resulting from cyclic loading during operation. Once these defects appear, they leads to the stop of production process, necessitating either replacement or repair. Welding repair (hardfacing) is a cost-effective alternative to complete replacement, but the fatigue resistance of the repaired zones must be evaluated. The objective of this study is to assess the fatigue characteristics of hardfaced layers in hot work tool steels used in the forging industry and compare them with the base material's fatigue properties. A defined welding procedure was applied to prepare hardfaced samples, from which test specimens were extracted for three-point bending crack growth testing. Additionally, hardness and microstructural analyses were conducted on the hardfaced layers and heat-affected zone (HAZ). Based on the results, conclusions were drawn regarding the suitability of welding for repairing forging tools.

Keywords: hot work tool steel; forging tool; fatigue crack; hardfacing

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