

# **Fatigue and Toughness Behaviour of Large Blooms for Plastic Molds and Relation with the Microstructure**

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## **Abstract**

Molds for plastic automotive components such as bumpers and dashboards are usually machined from large pre-hardened steel blocks. Due to their dimensions, quenching and tempering yield continuously varying mixed microstructures as the distance from the surface increases. As a consequence, fracture toughness as well as fatigue properties are not well defined and, in any case, lower than those of a fully quenched and tempered steel. Moreover, the final machining of the bloom may expose the heart microstructure in some parts of the mold surface, giving rise to not easily predictable toughness and fatigue behaviour.

An investigation of the mechanical properties of a few commercial blooms of 1.2738 steel was carried out, including tensile, Charpy V-notched, fracture toughness. The samples were obtained from different depths of the blooms. Some of them were tested in their original condition, while others were re-heat-treated by air quench and tempering.

Moreover some da/dN tests were carried out at different depths and both the threshold and the Paris zones were investigated. All the tests were carried out according to the compliance method for the determination of the crack length.

The relationship between mechanical properties, fracture surfaces, sampling position and microstructure was also investigated.

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