

Carbide-related effects on the fatigue behavior of high-strength tool steels in the field of cold work applications

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The requirements for tool steels have increased in recent years. For example, the trend in the automotive industry towards stronger sheet metal for the automotive industry is leading to higher tool loads in cold work applications, such as fine blanking, punching, and cold forming. A comprehensive understanding of the properties of these steels is therefore essential for the development of such steel grades. Besides high compressive strength, abrasive- and adhesive wear resistance as well as sufficient toughness, fatigue properties play a decisive role for improved tool life. All of these properties mentioned are often tested on tool steels, with the exception of fatigue behavior. Although some research has been carried out in the past, specific microstructural variations have not been tested so far. This paper will examine the effect of different microstructures on fatigue in more detail. In order to obtain a comparable basis, the microstructures were systematically altered by heat treatment so that a significant difference in primary carbide spacing and size could be studied at the same hardness level. Since in applications such as fine blanking and punching the temperature of the active elements can rise significantly during operation, additional fatigue tests were carried out at elevated temperatures. This makes it possible to study not only the influence of the microstructural parameters, but also the influence of the temperature on the fatigue properties.

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