Heat Treatment Effects on CPM-M4 Tool Steel Performance as Edged Blade Material

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Abstract

CPM-M4 tool steel is widely applied as knife blade materials due to its high mechanical performance, especially for its high wear resistance. The effects of heat treatment parameters on the edged blade performance are discussed in this study. Five heat treatments were applied on CPM-M4 steel by controlling austenitizing and tempering temperature. Microstructures were examined by two methods of SEM and EDX. Different edged performances were tested including hardness test, 3-Point bend test, impact test and CATRA (edge retention) test.

The results show that the austenitizing temperature is a significant factor that affects all these mechanical properties. Carbides fraction is a dominated factor in 3-Point bend test and can be maximized by controlling austenitizing temperature. Additionally, we can achieve comparatively high impact toughness in low austenitizing temperature without decreasing hardness through lowing tempering temperature, because tempering temperature has no significant effect on impact toughness. From the CATRA test, the edge retention of CPM-M4 steel relates to its hardness and can be improved by controlling both austenitizing and tempering temperature.

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