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Characterisation of a quenched, quenched & tempered AISI M2 HSS subjected to deep cryogenic treatment



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ABSTRACT:

AISI M2 HSS are well known for their wide industry usage due to its strength, and ability to retain red hardness at high temperature. To further enhance the mechanical properties relevant to its applications, deep cryogenic treatment is often applied as an extension to bulk heat treatment process, aimed at improving the mechanical properties and performance (hardness, wear resistance). AISI M2 HSS were investigated following different heat treatment processing sequences, such as Q, Q+DCT, Q+T, Q+T+DCT, Q+DCT+T, and characterised using a range of techniques. By varying the processing routes, the mechanical properties can be tailored to fit the relevant applications. For all DCT samples, analysis from SEM examination suggests an increase in the number of secondary carbides. XRD showed that these carbides are the type M₆C and MC carbide type, beneficial for the materials strength and resistance to wear. It was also shown that amount of retained austenite was found to be low for all DCT samples, with lowest reduction (3.1%) obtained for Q+DCT+T samples. Hardness test results revealed that an increase in hardness could be obtained following DCT. Nevertheless, the level of increase was dependent on the processing sequence employed. A clear trend found suggests that employing DCT between conventional prepared Q & T gave an increased hardness of approximately 4.1 %, with p value ($p < 0.05$), suggesting the values obtained are significant (0.009).



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