Thermally activated formation of martensite in Fe-C alloys and Fe-17%Cr-C stainless steels during heating from boiling nitrogen temperature

The thermally activated austenite-to-martensite transformation was investigated by magnetometry in three Fe-C alloys and in two 17%Cr stainless steels. After quenching to room temperature, samples were immersed in boiling nitrogen and martensite formation was followed during subsequent (re)heating to room temperature. Different tests were performed applying heating rates from 0.5 K/min to 10 K/min. An additional test consisted in fast (re)heating the samples by immersion in water. Thermally activated martensite formation was demonstrated for all investigated materials by a heating rate-dependent transformation curve. Moreover, magnetometry showed that the heating rate had an influence on the fraction of martensite formed during sub-zero Celsius treatment. The activation energy for thermally activated martensite formation was quantified in the range 11–21 kJ/mol by a Kissinger-like method.

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