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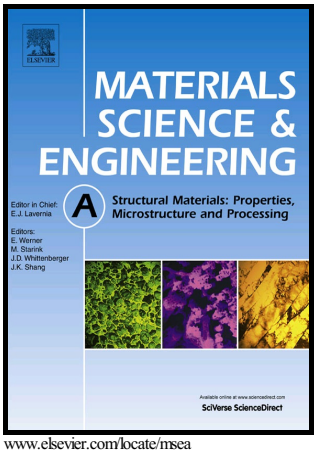

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Ji Dong, Xiaosheng Zhou, Yongchang Liu*, Chong Li, Chenxi Liu, Huijun Li

State Key Lab of Hydraulic Engineering Simulation and Safety, School of Materials Science & Engineering, Tianjin University, Tianjin 300072, P R China

*Corresponding author. Tel./fax: +0086 22 87401873. licmtju@163.com

Abstract:

Microstructure evolution and mechanical performances of the Nb–V–Ti microalloyed ultra-high strength steel subjected to quenching–partitioning–tempering (Q–P–T) treatment are investigated by SEM, TEM, XRD examination and mechanical tests. After Q-P treatment, the microstructure consists of multiple phases, including lath martensite, retained austenite and small amount of twin martensite. Moreover, three types of carbides have been identified, namely M_3C, Nb-rich MC and Ti-rich MC. By conducting tempering treatment, martensite lath is recovered, and the volume fraction of retained austenite is decreased, as well as the carbon concentration in retained austenite. M_2C, M_7C_3 and $M_{23}C_6$ are precipitated at the expense of M_3C in tempering process. In addition, part of M_7C_3 are transformed to $M_{23}C_6$ with the increase of carbon partitioning time, and the other two types of MC precipitates are found to be the stable phases existing during tempering treatment. In both of the samples after Q-P and tempering process, martensite lath width, the volume fraction of retained austenite and the carbon content in retained austenite increased as the partitioning time is prolonged. After tempering process, the impact toughness first increased and