Prediction of the Ductile-to-Brittle Transition Temperature of a silicon steel under various strain rate conditions

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Abstract. This paper is concerned with the construction of an empirical model of the Ductile-to-Brittle Transition Temperature (DBTT) of 3.4 % silicon steel at strain rates from 0.001 s^{-1} to 100 s^{-1}. The constructed model is based on tensile tests results of 3.4 % silicon steel with a thickness of 1.6 t. Dynamic tensile tests were conducted using in-house servo hydraulic tensile test machine (HSMTM) with the chamber and quasi-static tensile tests were conducted using Instron 4206 with the chamber. Fracture elongation was measured by DIC method during all tests using the high-speed camera for accurate measurement. The DBTT of 3.4 % silicon steel is presented in terms of fracture strain with the various temperature at various strain rates. From the tests results, it is demonstrated that the DBTT increased as strain rate increase. The empirical model of the DBTT is constructed in terms of strain rate, temperature and fracture elongation. The parameters of the empirical model were obtained from tests results.