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Evaluation of the failure mode transition in high strength TMCP steel weld by Charpy impact test

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There are strong demands for lightweight structures in cold regions, where construction cost penalties increase tremendously with remoteness of the locations and heaviness of the construction materials and equipments. High strength steels make it possible to design not only lightweight structures, but also simple structures with simple joint details. Among these, TMCP (thermo-mechanical controlled process) steels are now spot lighted due to the excellent mechanical properties of strength, toughness and weldability. Like most structural steels, the fabrication of structural member using TMCP steels always involves welding process such as FCA (flux cored arc) welding. Therefore, for the application of TMCP steels to cold regions, it is a prerequisite to clarify the ductile-to-brittle transition temperature in the welded joints in order to ensure the structural integrity of the welded structures. In this study, the Charpy impact test was conducted to evaluate the ductile-to-brittle transition temperature of the weld. The base material used is high strength SM570 TMC steel plate with 18 mm thickness. Double 'V' butt joint configuration was constructed using a multi-pass welding process. The impact specimens were extracted from the weld metal, the HAZ (heat affected zone) and the base material. Standard V-notch Charpy specimens were prepared and tested under dynamic loading condition. The transition temperatures of the weld metal, HAZ and base metal were derived by the impact test, and the applicability of the TMCP steel weld to cold regions was discussed in detail.