Data Descriptor

Crack Mouth Opening Displacement for EH36 Shipbuilding Steel Measurements Dataset

Jakub Kowalski[1*], Janusz Kozak[1]

[1] Faculty of Mechanical Engineering and Ship Technology, Institute of Naval Architecture and Ocean Engineering, Gdańsk University of Technology; (11/12 Gabriela Narutowicza Street, Gdańsk, Poland)

[*] Correspondence author: jakub.kowalski@pg.edu.pl; ORCID: 0000-0001-9603-1220

Abstract

The dataset titled EH36 steel for shipbuilding (plate thickness 50 mm) – CMOD – force record, a0/W=0.6 contains a CMOD (Crack Mouth Opening Displacement) – Force record which is the base for evaluation of the fracture toughness of structural steel. Bend specimens with a Bx2B section (B = 50 mm), and relative initial crack length a0/W=0.60 were used. The test was carried out at ambient temperature in accordance with the ISO 12135 standard. The dataset can be useful in the calibration of numerical material models which includes ductile failure. It can also be use as reference data in the comparison of the toughness designations of carbon steels.

Keywords: fracture toughness; CMOD; ductility

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Specification table (data records)

Subject area	Mechanical engineering, mechanical properties of material, fracture toughness
More specific subject area	Ductility of structural steel
Type of data	Text
How the data was acquired	The data was collected at the Gdańsk University of Technology on a dedicated test stand. All calibrated voltage signals (from a force transducer and extensometer) were measured and recorded by a HBM Quantum MX840A device
Data format	The tables are in .ods format

Experimental factors	The data contained in the dataset were zero balanced and filtered
Data source location	MOST Wiedzy Open Research Catalog, Gdańsk University of Technology, Gdańsk, Poland
Data accessibility	The dataset is accessible and is publicly and freely available for any research or educational purposes

Background

The fracture toughness of material is one of the critical issues for marine structures built with thick plates. The Charpy impact test, which is typically used in case of thin and moderately thick plates, may not be sufficient in the case of thick structures. In such cases, some additional requirements are defined (DNV GL, 2019). On of these is a Fracture Mechanics (FM) based test – CTOD (Crack Tip Opening Displacement) test. The FM test is to be performed with specimens prepared from a full thickness plate. In this particular case (plate thickness 50 mm, specimen for three point bend test), the dimensions of the specimen are as follows: 50 × 100 × 460 mm and weight about 18 kg. The presented dataset is part of research on the scale effect and relative notch depth in fracture mechanics testing of high tensile steels for shipbuilding (Kowalski and Kozak, 2018b, 2018a)there is a risk of appearance of brittle fracture. This risk is reduced through the use of certified materials having guaranteed strength at a given temperature. A method which is most frequently used to determine brittle fracture toughness is the Charpy impact test, preformed for a given temperature. For offshore structures intended to work in the arctic climate, the certifying institutions more and more often require Crack Tip Opening Displacement (CTOD).

Methods

Fracture toughness test methods are standardised. The presented dataset fulfils the requirements of (British Standards Institute, 1991) and (ISO, 2016). A three point bend specimen with the breadth-to-width ratio B/W = 0.5 and relative crack length a0/W = 0.6 was used – see Fig. 34.1. The test was performed at ambient temperature (23 ±5°C). Crack extension during stable tearing was not included.

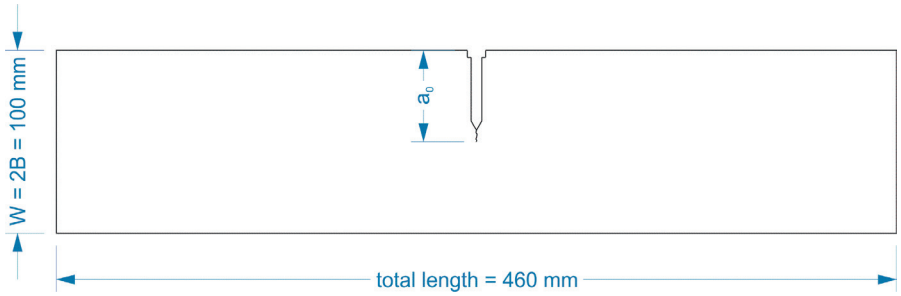

Fig. 34.1. Dimensions of applied specimen

The data was acquired on a ±250 kN dedicated stand in displacement controlled mode. CMOD was measured by an Epsilon 3541-010M-120M-LT extensometer, with a gauge length of 10 mm and range –2, +12 mm.

Data quality and availability

All of the applied measuring equipment was calibrated by an external, independent certification body. The laboratory estimated the measuring uncertainties. The collected data were manually checked, zero-balanced and filtered.

Dataset DOI
10.34808/y12d-ph76

Dataset License

Acknowledgements

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References

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