

# Lab Assignment 2 – Fracture

## Description

This assignment is designed to clarify the concepts of **ductile** and **brittle** fracture as well as **impact testing** and **data analysis**. The content is taught by conducting a Charpy V-notch (CVN) impact fracture test of a typical structural steel. After this assignment, the student can independently prepare, conduct and interpret impact test results and is able to form a link between fracture theory and practical testing.

You will continue in the same teams as for Lab 1. The team needs to prepare, conduct and report the results from a test series which characterizes the fracture behavior of a structural steel at different temperatures.

## Preparation

Prior to conducting the study, it is necessary for each team to familiarize themselves with fracture theory and testing standard ISO 148-1:2016. Reading the standard *before* going to the lab is required. The standard is available online via Aalto library services. You should read all of it.

## Execution

Each group has a two-hour time slot. The first hour is spent discussing with the course assistant. Be prepared to explain what a tensile test is, what is measured and how, how is that measurement used, how reliable is it etc. The second hour is spent conducting the experiment with the help of a lab technician. You are responsible of recording all necessary data needed for reporting (read the standard, so you know what you need).

**TIME:** A timeslot for the practical work is reserved during the first lecture in MyCourses.

**PLACE:** K2-Building @ Puumiehenkuja 3. The course assistant will meet you at the lobby.

## Report

A report will be written explaining to the reader why, how and what was done. The structure follows the typical scientific paper: IMRaD (Introduction, Methods, Results and Discussion). List of references is included last as well as any possible appendices. The report draft should include an *introduction* chapter where the theory of ductile/brittle fracture is explained. Why does temperature affect the behavior and for which materials? Why is it important to know the behavior? How can we measure impact toughness? Why do the absorbed energies vary and why do the fracture surfaces look different at different temperatures? How reliable is the data and how many samples do we need to break before we know the behavior for sure?

The report draft should also contain a *methods* chapter describing the standard test method: sample,

environment, test equipment, reporting and data analysis. The level of detail should be such that someone else could repeat your experiments and get the same results. The results chapter will include data points given in MyCourses complemented with the test data that the team records. The data is presented according to the standard's chapter 9 and its annexes. **ALL** listed values should be reported, i.e. 9.1 a-g and 9.2 a-k as well as three graphs described in Annex D.1 (T-KV, Transition curves for shear fracture area and for lateral expansion). The discussion section contains the verbal analysis of the results and it should explain the differences in fracture behavior in various temperatures and the reliability of the results.

**DEADLINE:** The report should be uploaded to MyCourses in Word or PDF format before the following Monday 23:59. Write the names of every student in the group on the cover page.

## Contact

If you have any questions regarding the assignment, you can contact the course assistant via e-mail ([goncalo.sorger@aalto.fi](mailto:goncalo.sorger@aalto.fi)). MyCourses will be used for uploading files and sending messages to the course participants. The team leader is by default responsible for correspondence with course staff.