ISO 18488 , ISO 18489 Strain Hardening – Resistance to Slow Crack Growth (SCG, ESC)

Description

ISO 18488 Test Machine (Strain Hardening)

Methods for characterization of slow crack growth

Pipes made of polyethylene such as PE80, PE100 or the improved PE100RC display differing levels of sensitivity to slow crack growth. The terms “Environmental Stress Cracking” (ESC) and “Slow Crack Growth” (SCG) are used to describe this behavior. A failure of this type takes place well below the yield stress of the material and is therefore of enormous significance in the long-term assessment of the mechanical properties of the material.
A range of tests has evolved to characterize this mechanism. These include:

- Creep tests with constant internal pressure: ISO 1167, ISO 9080
- Slow crack growth on notched pipes: ISO 13479
- Full notch creep test (FNCT): ISO 16770
- Polyethylene notch tensile (PENT) test: ASTM F1473, ISO 16241
- Bent strip ESCR test: ASTM D1693
- Cone test method: ISO 13480

For acceleration the test is performed with a sharp initial notch, at raised temperature and in a liquid with an surfactant effect, usually *Igepal*® CO-630.

Recent research has generated additional test methods which allow good assessment of ECG properties with very short test duration.

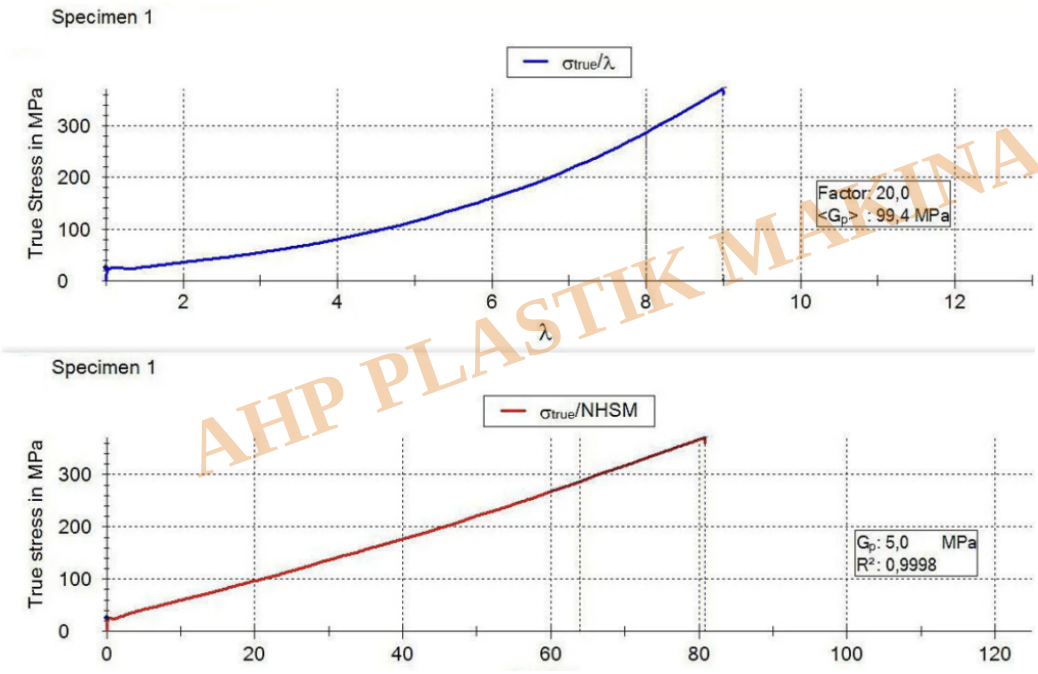
The following standards were published in 2015:

- ISO 18488 Polyethylene (PE) materials for piping systems — Determination of Strain Hardening

Modulus in relation to slow crack growth
- ISO 18489 Polyethylene (PE) materials for piping systems — Determination of resistance to slow crack growth under cyclic loading — Cracked Round Bar test method

Determination of strain hardening modulus to ISO 18488

The specimen shape used for this test method is a small dumbbell with relatively wide shoulders; measurement is performed under tensile loading. PE strain hardening modulus is measured at a temperature of 80°C with a deformation ratio ? between 8 and 12. This corresponds to a strain interval of 400% between the 700% and 1100% strain points. In this range the polymer is already fully stretched, allowing the deformation behavior of the fibrils to be measured. The diagram for true stress over neo-Hookean strain (?² – 1/?) shows a virtually linear gradient for PE. This gradient is described by a linear equation in the form **? true = Gp (?² – 1/?) +C**. Gp is the gradient factor of the lines.



Related Products ISO 18488

Strain hardening modulus measurement to **ISO 18488** requires an electromechanical testing machine equipped for example as below:

- Standard double column tensile tester capacities of 5KN, 10KN (Higher accuracies obtained with loadcell of 1KN)
- Temperature chamber which permits a tensile clamp movement
- Video extensometer
- Parallel-clamping pneumatic or manual grips
- Standard Test Program to **ISO 18488** displaying “true stress” over neo-Hookean strain, as well as “true stress” over deformation ratio ? and calculation of GP and check of regression coefficient r

Determination of the resistance against slow crack growth under cyclic loading, to ISO 18489

This method uses a cylindrical specimen, in which a rotating initial notch has been inserted. Cyclic loading with constant force amplitude is applied to this specimen. The force amplitude is selected in order to allow slow crack growth.

The test result is the number of cycles until specimen failure and is displayed as a function of the applied stress ??0 at the initial crack length.

Test duration is kept to a minimum with the new test method to **ISO 18489**. It should be reduced especially at the height of the cyclic loading depending on the specimen geometry. Another advantage of this test method is that it can be performed at room temperature so that the polymer structure of the specimen is maintained.

Related products ISO 18489

- Constant load cyclic testing machine with force level control
- The loading cycles are applied precisely and uniformly.
- strain control via a connected extensometer.
- The wear-free drive and low power consumption ensure low ongoing operating costs.
- Standard software controls the entire test sequence and produces the results in a format that is clear and exportable.

Tensile Tester with Temperature Cabin for Strain Hardening Tests ISO 18488

- Video extensometer is included
- Windows-based software specially for measurement of strain hardening modulus
- MS Excel report
- SS304 temperature cabin for temperatures up to 80C
- Glass door for temperature cabin
- Air circulation system for temperature homogeneity inside test chamber
- Servomotor controlled
- Ball screw moving mechanism

- USB port for connection to computer
- 50Kgf load cell is proposed for measurements
- Maximum force capacity of the machine is 10KN
- Wedge grip for low thickness samples up to 2mm
- Computer is an option and will be quoted separately
- Training video included
- Travel distance for the sample piece inside the chamber, including grips, is a maximum of 500mm

Category

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