



## Technical leaflet

# Peeling Test

Innovative  
Surface characterisation



## Introduction

The main aim of the test is to reveal strength/cohesion of the surface investigated. A sequence of adhesive tape strips is applied one by one to the surface and then peeled off. The weight of the material stuck to the tape is measured on laboratory scales.

The free software allows the user to evaluate the measurement sequence and determine the deterioration of the surface from its bulk strength. The application consists of the executable program and auxiliary libraries.

## Surface degradation model

Analyzing the sequence of removed material's weights  $m(n)$ , one can, essentially, find two components: the variable one related to the surface deterioration and the constant one, reflecting intact bulk cohesion of the intact material.

$$m(n) = A + B * e^{-C*n}$$

According to the peeling-test model, the intact material's cohesion manifests itself as constant amount of removed material in the peeling sequence, denoted as A in the formula. The weight of this material corresponds to the fragments broken off from the surface in the process of affixing the strip on the surface. It assumes that this component would remain constant if the peeling is repeated again and again.

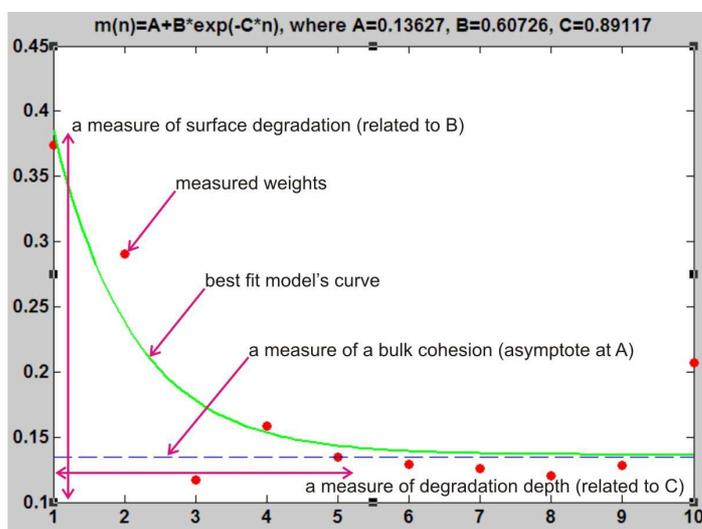


Fig. 1: Example explaining the coefficients in the surface degradation model.



The second component of the weight of the removed material in the sequence, denoted as  $B$  in the formula, is a measure of the deterioration of the investigated surface with depth – the higher the ratio  $B$  to  $A$ , the more significant the degradation is. The exponent  $C$  relates to the depth of the degraded layer – the bigger the value of  $C$  the steeper the curve in Fig. 1, which means there is a quicker decrease in weight in the sequence of the removed material, indicating that the degraded layer is thinner. Fig. 1 explains the meaning of the parameters  $A$ ,  $B$  and  $C$ .

The ten strips in each kit are adequate for determination of the parameters  $A$ ,  $B$  and  $C$  in the formula.

### Comparative tests

Putting statistics aside, two or three tests are necessary in order to compare the effectiveness of a surface treatment with the untreated surface, or to compare one consolidant with another or simply with distilled water used in the same way. The latter case refers to the fact that part of the weathered/deteriorated surface might be inadvertently "brushed off" merely by the application technique, resulting in a seemingly improved surface. The subplots  $d$  and  $f$  in Fig. 2 depict the peeling behaviour of untreated deteriorated mortar surfaces. Subplots  $e$  and  $g$  show the altered peeling properties of the surfaces after treatment with CaLoSil: the surface was significantly improved by the treatment.

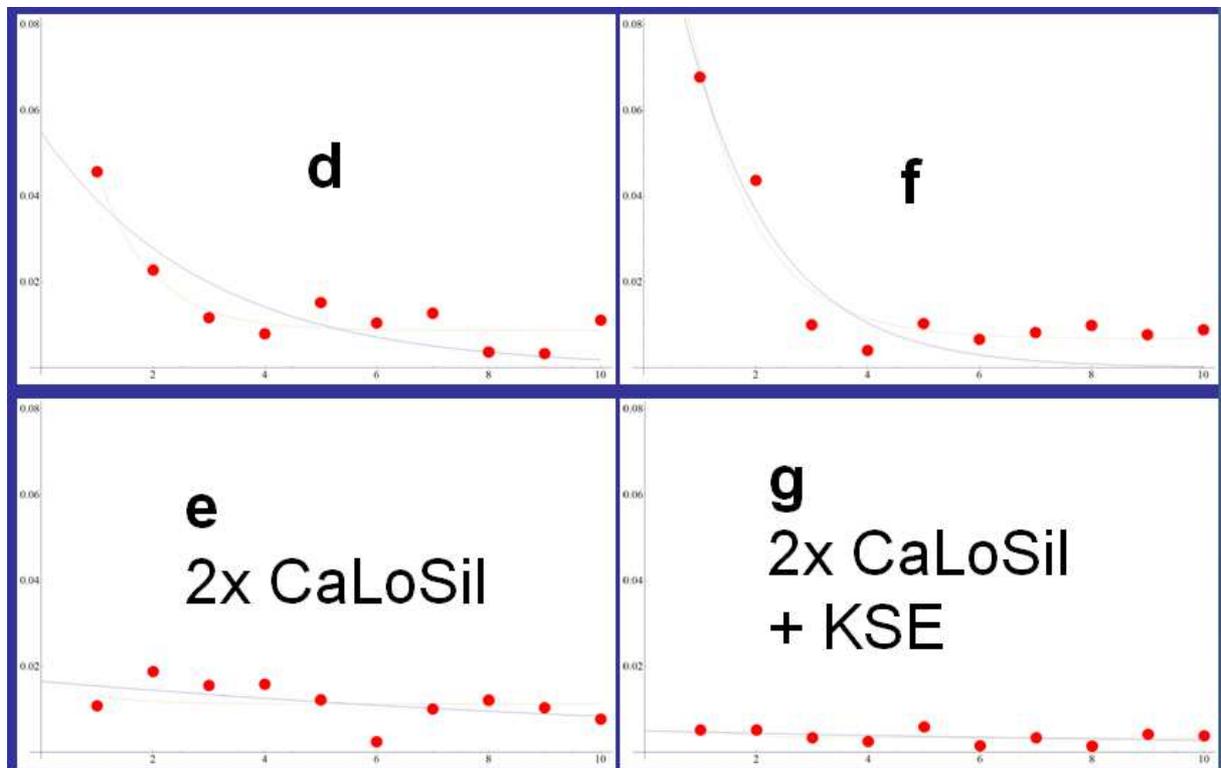


Fig. 2: Typical graphs obtained in peeling tests



## **Experimental procedure**

Using the sequence of packets from 1 to 10, the proper peeling-test procedure is as follows (Fig. 3):

1. Pick the packet of the appropriate number
2. Remove the self-adhesive strip from the zip-lock packet
3. Remove the film covering the adhesive part of the strip
4. Apply the strip to the surface being tested, using moderate pressure evenly
5. Remove the strip from the surface and cover it with the film previously removed
6. Put it into the zip-lock packet again
7. Weight it on laboratory scales, the measured weights should be determined to four significant figures.

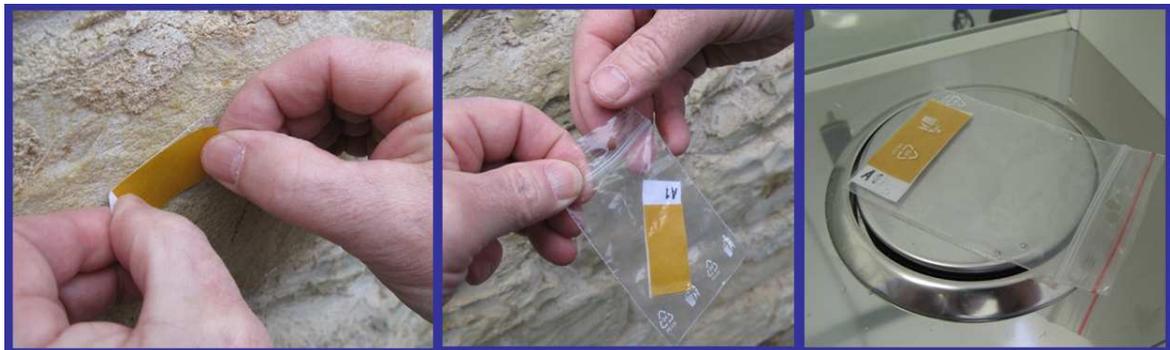


Fig. 3: Experimental procedure

## **Data processing**

The measured values have to be processed in the following way:

1. The weight of any given packet can be found printed on the kit envelope
2. The net weight of the removed material is the difference between the weight of the packet before and after application of the adhesive strip to the surface under test. The packet weight before application can be found printed on the kit envelope.
3. The weight sequence should be stored as one column of numbers in a text (.txt or .data extension) file, one value per one line.
4. The data file is then processed by the freely provided application.

## **Using the free application for peeling evaluation:**

1. Installation
  - a. The zipped directory containing the program and libraries can be downloaded from the webpage: [www.arcchip.cz/peeling-test](http://www.arcchip.cz/peeling-test).
  - b. After download, folder "peeling-test" should be created by unzipping.
  - c. As the application is based on Matlab libraries, these have to be installed first. In subfolder "win32" of the unzipped "peeling-test" folder, file



- d. "MCRIInstaller.msi" can be found. A Double-click would install these libraries in a system suggested location and in a manner usual for Windows application.
2. Running the application
  - a. The application for evaluation called ""peeldatf.exe" can then be started by double-clicking its icon in the "peeling-test" directory.
  - b. In the next step a file containing the weight data has to be put in the standard window for file selection.
3. Results

Finally, application displays a plot of the measured weights and the best fit curve using the data model for the formula parameters. The Formula parameters are displayed in the title of the plot. The plot can be saved in various formats.

## **Warning**

The adhesive tape strips can attach to the surface with a remarkable adhesive force, such that during their removal, a substantial amount of material can be removed from the surface. Therefore, it is advisable to evaluate the peeling test on areas less visually exposed first, in case they are very fragile and likely to be damaged.

## **Contact**

Questions and requirements should be addressed to [itam@itam.cas.cz](mailto:itam@itam.cas.cz). or [info@ibz-freiberg.de](mailto:info@ibz-freiberg.de)

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