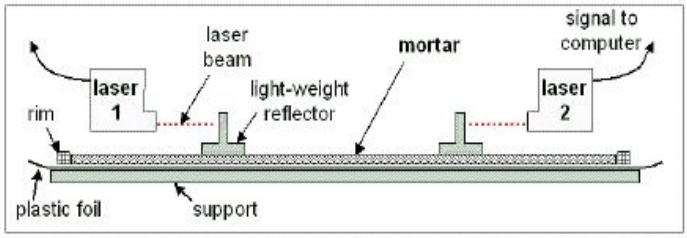
Schleibinger Geräte Teubert u. Greim GmbH

The Schleibinger Thin Layer Shrinkage Laser Measurement System

Some building materials like self-leveling flooring compounds ore plasters are applied in thin layers. These fast setting mortars set and harden within a couple of hours and subsequent drying of such a thin layer is generally terminated after the first day. In order to investigate the dynamics of early shrinkage and expansion we developed a special set-up of two laser units which are horizontally aligned. This set-up allows to investigate the different formulation parameters and their influences onto the different stages of shrinkage and expansion, namely the plastic shrinkage, setting expansion and drying shrinkage. The shrinkage or expansion behavior is strongly related to both, external (climate) and internal (formulation) factors. With respect to the latter, begin, intensity and duration of setting are key to the overall shrinkage or expansion behavior.

With building materials applied in thin layers shrinkage is one of the major issues because of two reasons: The high surface-volume ratio causes evaporation to be a dominant mechanism for strong and fast physical shrinkage, and the intense hydration reactions can cause a pronounced chemical shrinkage, or in case of ettringite formation a strong expansion.

Method



To investigate early shrinkage/expansion mechanisms in fast setting thin mortar layers a special set-up was developed which consists of two laser units. The two lasers are directed horizontally onto a pair of light-weight reflectors, which are placed on top of the fresh mortar. The change in distance between the reflectors is then registered with an accuracy of 0.1 μm. The non-contact laser device allows to start measurement right after emplacement of the fresh mortar.
A data-logger supplied with the system records the data and store it in the logger as standard ASCII files. Optional a synchronous registration of temperature and humidity ore of a balance (Mettler) is possible. Two temperature channels and a mixed temperature /humidity channel are available. For measuring the vertical shrinkage the Laser sensors may be turned in the vertical direction. You may the measure directly on a mortar surface, or you may use the Schleibinger Shrinkage Cone vessel.

The logger has a network interface (Ethernet). So you can easily integrate it into local intranet. With a standard web-browser software you can readout the data, and visualize it. For further data handling we recommend Microsoft Excel ® ore any similar visualisation program. The data are visualized online graphical and numerical on the screen. No special PC software is necessary. You need only your browser-software like Mozilla ore Internet-Explorer ® .

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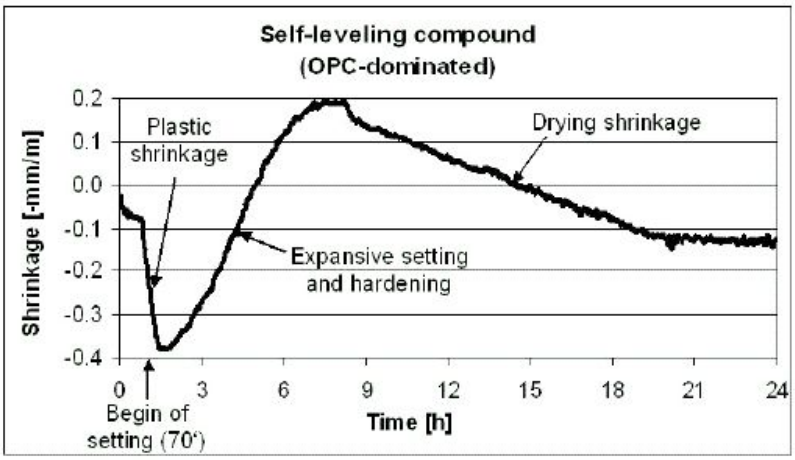
An example measurement



The picture below shows a strong plastic shrinkage (shrinkage before setting) in the first hour. Close to the begin of setting, plastic shrinkage can turn suddenly into expansion. The current working hypothesis is that this is a pure structural effect related to a critical concentration of hydrates, which cause the mineral grains (cement, sand and fine-grained fillers) to become supported by a matrix of hydrates. From this moment on any further hydration causes the mineral grains to be pushed apart (expansion). The ongoing chemical shrinkage (caused by continued hydration), which contributed to plastic shrinkage before, is now producing porosity. As the hydration rate decelerates, evaporation becomes the dominant mechanism and forces the mortar layer to shrink again. In most cases, this drying shrinkage levels out during the first day and the mortar layer becomes stable in volume . Picture with courtesy of Bühler and Zurbriggen, elotex AG, Switzerland

Technical Data :

Measurement range	2 * 5 mm
Specimen size	Max 30x25 cm
resolution	0,1 µm
Laser-spot diameter	0,8 mm
Security note	Laser power 1 mW at 625 nm, class 1

Order Info

incl. Boom stand, 2 Laser sensors, laser electronic, data logger software user manual

S0060	Thin-Layer-Shrinkage-Laser-Measurement-System
S0030	Interface for Mettler-Toledo Balance
S0013	Temperature Measurement Channel
S0016	Temperature and Humidity Measurement

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