Expert Opinion

Investigations of HASIT Fixit 222 Aerogel WDP sample plaster

Property:	Trausnitz Castle HASIT Fixit Aerogel WDP Landshut sample plaster surfaces
Client:	HASIT Trockenmörtel GmbH Landshuter Str. 30 85356 Freising
Contractor:	IGS Institut für Gebäudeanalyse und Sanierungsplanung München GmbH Glückaufstraße 12 83734 Hausham
Processor:	Dipl.-Ing Rolf Kaiser Bernd Backhaus, Civil Engineer

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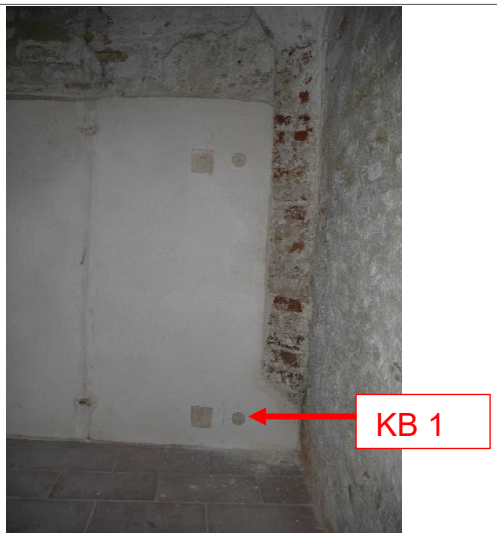
Project: 03021 G02

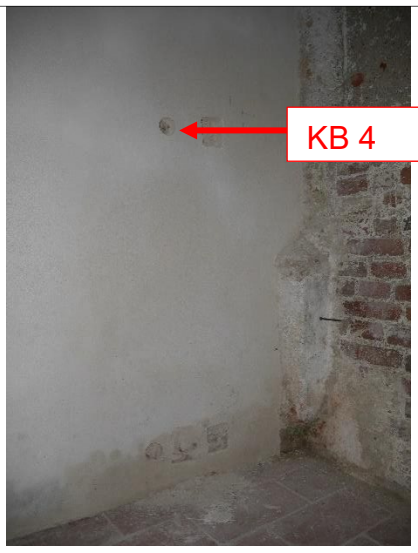
IGS was commissioned by HASIT to carry out structural investigations on the two plaster sample areas in the cellar area of Trausnitz Castle in Landshut. Investigations were carried out on moisture and salt loads of the plasters and, in addition, climate measurements were carried out to assess possible condensation processes on the plaster surfaces in the summer phase.

1. Investigations into moisture and salt loads

On 16.06.2021, a total of 20 material samples of the above-mentioned plaster system were taken at 6 locations by means of core drilling in the area of the sample surfaces of the above-mentioned project and examined laboratory for the moisture content and the content of structurally damaging salts.

Documentation of sampling:

Sample	Location / altitude	Photo documentation
KB 1	Upper room, sample surface on the right edge Height: 0,16 m	

KB 2	Upper room, sample surface on the right edge Height: 1.35 m	
KB 3	Lower room, sample surface on the right edge Height: 0.16 m	
KB 4	Lower room, sample surface on the right edge Height: 1.35 m	

KB 5	Lower room, sample area in the middle (under wall niche) Height: 0,10 m	
KB 6	Lower room, sample area in the middle (under wall niche) Height: 1.35 m	

The results of our laboratory tests are presented in the following tables.

Exposure to moisture:

To determine the exposure to moisture, the sample material was weighed and the material moisture content was determined using the Darr method.

Results:

Sample type	Sample no.	Removal height above top	Material	Material moisture
KB	1/0.5	0.16	Lime plaster, finishing plaster	1.64
KB	1/0.8	0.16	Render/finishing plaster boundary layer	5.00
KB	1/3	0.16	Render (aerogel)	24.60
KB	1/5	0.16	Render (aerogel)	35.95
KB	2/0.5	1.35	Lime plaster, finishing plaster	4.19
KB	2/0.8	1.35	Render/finishing plaster boundary layer	7.17
KB	2/2	1.35	Render (aerogel)	19.38
KB	2/4	1.35	Render (aerogel)	24.07
KB	3/0.5	0.16	Lime plaster, finishing plaster	12.74
KB	3/1.5	0.16	Render (aerogel)	51.55
KB	4/0.5	1.35	Lime plaster, finishing plaster	3.46
KB	4/1.5	1.35	Render (aerogel)	10.50
KB	4/4	1.35	Render (aerogel)	14.17
KB	5/0.5	0.10	Lime plaster, finishing plaster	23.58
KB	5/2	0.10	Render (aerogel)	67.04
KB	5/2.5	0.10	Render (aerogel)	33.20
KB	6/0.5	1.35	Lime plaster, finishing plaster	4,59
KB	6/0.8	1.35	Render/finishing plaster boundary layer	14.35
KB	6/3	1.35	Render (aerogel)	19.01
KB	6/5	1.35	Render (aerogel)	18.64

KB = core drilling, the number after the slash indicates the extraction depth.

Exposure to structurally damaging salts:

To determine the salt load, an aqueous extract was made from a defined amount of building material. In this solution, the content of the water-soluble anions was determined using an ion chromatographic analysis technique.

Sample no.	Removal height above top edge of floor	Material	Salt load [wt. %] BS = assessment level					
			Chloride	BS	Nitrate	BS	Sulphat	BS
1/0.5	0.16	Lime plaster, finishing	0.160	I	0.034	I	0.111	I
1/0.8	0.16	Render/finishing plaster boundary	0.242	II	0.000	-	0.124	I
1/3	0.16	Render (aerogel)	0.485	II	0.083	I	0.945	II
1/5	0.16	Render (aerogel)	0.056	I	0.025	I	0.066	I
2/0.5	1.35	Lime plaster, finishing	0.493	II	0.399	III	0.253	I
2/0.8	1.35	Render/finishing plaster boundary	0.667	III	0.664	III	0.252	I
2/2	1.35	Render (aerogel)	1.331	III	1.736	III	0.468	I
2/4	1.35	Render (aerogel)	1.116	III	1.303	III	0.402	I
3/0.5	0.16	Lime plaster, finishing	0.064	I	0.000	-	0.040	I
3/1.5	0.16	Render (aerogel)	0.092	I	0.100	II	0.052	I
4/0.5	1.35	Lime plaster, finishing	0.626	III	0.205	II	0.112	I
4/1.5	1.35	Render (aerogel)	1.206	III	0.422	III	0.178	I
4/4	1.35	Render (aerogel)	2.302	III	0.874	III	0.147	I
5/0.5	0.10	Lime plaster, finishing	0.035	I	0.000	-	0.000	-
5/2	0.10	Render (aerogel)	0.032	I	0.000	-	0.000	-
5/2.5	0.10	Render (aerogel)	0.038	I	0.000	-	0.000	-
6/0.5	1.35	Lime plaster, finishing	0.828	III	0.247	II	0.137	I
6/0.8	1.35	Render/finishing plaster boundary	2.058	III	0.857	III	0.167	I
6/3	1.35	Render (aerogel)	2.647	III	1.137	III	0.329	I
6/5	1.35	Render (aerogel)	2.550	III	1.169	III	0.256	I

Assessment table for damage-causing effect according to WTA leaflet 4-5-99/D, Table 8:

Assessment level		wt. % chloride	wt. % nitrate	wt. % sulphate
I	low	< 0.2	< 0.1	< 0.5
II	medium	0.2 - 0.5	0.1 - 0.3	0.5 - 1.5
III	high	< 0.5	< 0.3	< 1.5

2. Climate measurements - surface temperatures and condensation hazard

In order to check the extent to which condensation processes on the plaster surfaces in the summer phase (summer condensation) have an influence on the exposure to moisture of the plasters, climate measurements were carried out in the period from 23.06.2021 to 06.10.2021 with recording of air temperatures, relative humidity and surface temperatures.

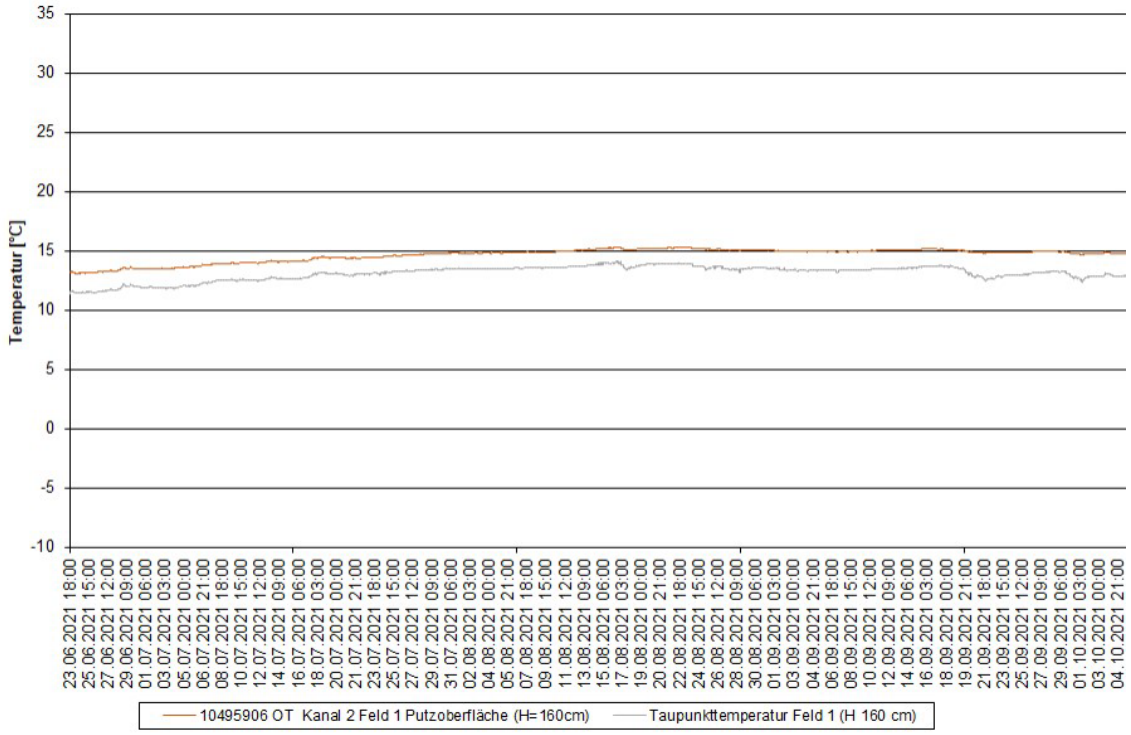
The following table documents the measuring points:

Measuring	Location	Logger	
1	Field 1: Lower room, sample surface, height 160 cm above top edge of floor	10495906 K2	
2	Field 1: Lower room, sample surface, height 6 cm above top edge of floor	10495906 K1	
3	Field 2: Upper room, sample surface, height 15 cm above top edge of floor	10018830	

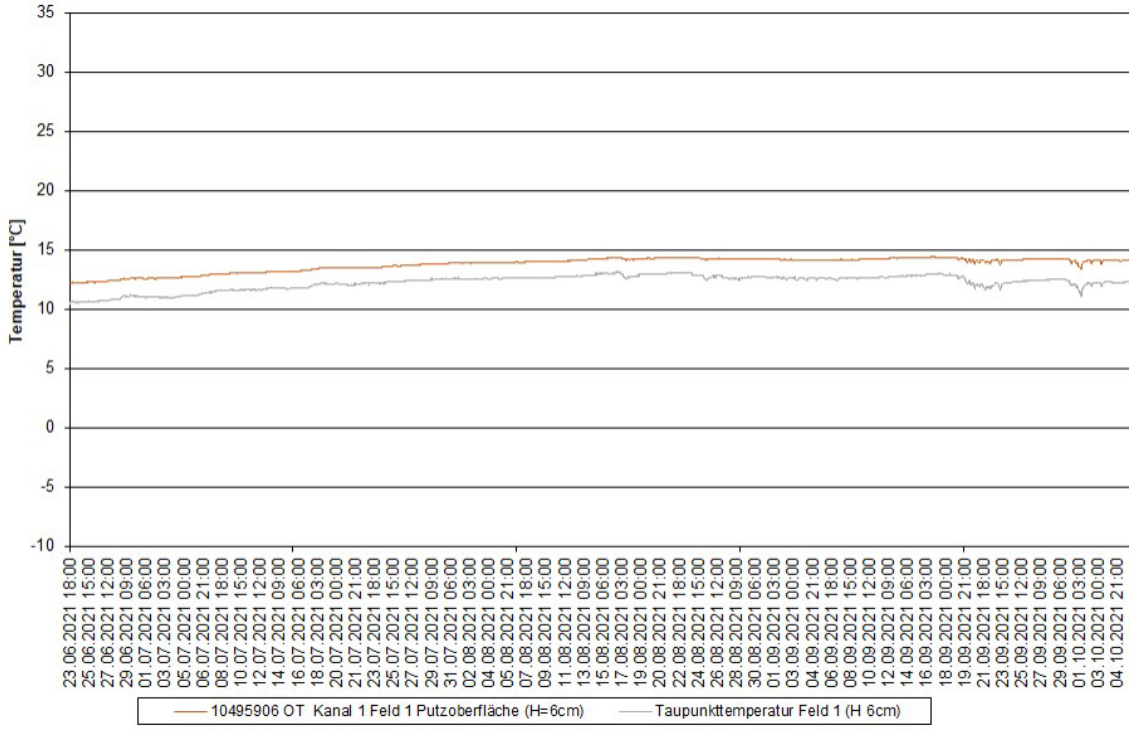
To check the extent to which condensation occurs on the plaster surfaces in the summer phase, dew point temperatures and surface temperatures were compared on both sample surfaces. The

following figures show that there were no periods of condensation during the measurement period, there was a dew point distance of approx. 2 K throughout.

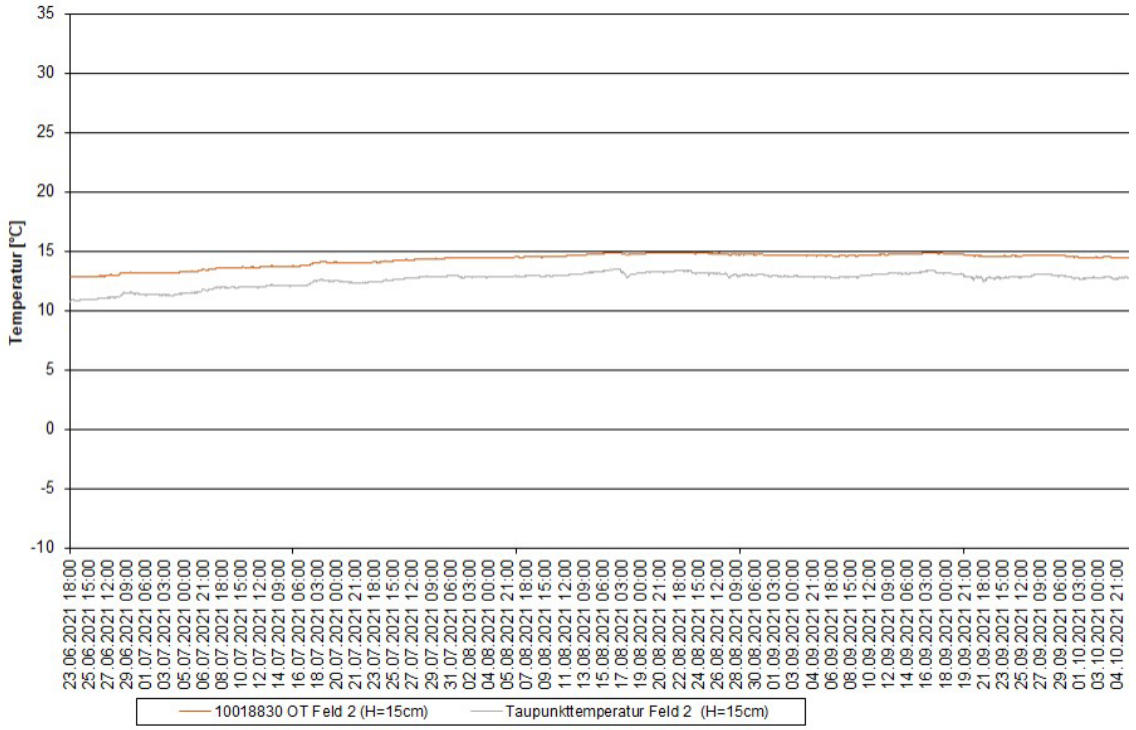
Curve of dew point temperature and surface temperature measuring point 1:



Curve of dew point temperature and surface temperature measuring point 2:



Curve of dew point temperature and surface temperature measuring point 3:



3. Evaluation of the results

The climatic investigations show that condensation processes did not occur on the component surfaces of the plaster samples during the summer phase. This means that there is no (additional) exposure to moisture as a result of condensation on the plaster surfaces.

The sometimes high to extreme exposures to moisture of the plaster layers are due to moisture ingress from the subsoil (outer wall in contact with the ground).

The investigations of the exposures to moisture of the aerogel plaster layers show that the plaster has a very high water absorption capacity and a high capillary absorbency. From the investigations and the moisture distribution of the plaster layers, it can be deduced that the aerogel insulation plaster designed as a concealed plaster can absorb moisture from the substrate without damage and transport it to the room-side component surfaces.

The investigations on structurally damaging salts usually show high to extreme concentrations of chlorides and nitrates, with comparable concentrations occurring in all plaster layers. The distribution of the salt load shows that the dissolved salts are “transported” through the individual plaster layers towards the component surfaces. Astonishingly, after about 3 years of standing time of the plaster samples, there is no damage to the component surfaces as a result of the high salt loads.

In the course of the investigations, it was noticeable that despite the high exposure to moisture of the plaster, there were apparently no signs of mould infestation. In this context, if one considers the climatic conditions in the summer phase with very high relative humidity of over 90% throughout, the plaster material used can be judged as inhibiting mould infestation or as “mould-resistant”.

While extracting the material samples, it was found that the plaster material, aerogel insulation plaster, could be removed from the substrate very easily and without major mechanical effects. With light manual and, above all, non-destructive action, the plaster material could be removed from the substrate without leaving any residue. With regard to the application of plaster on historic buildings, this is to be viewed and evaluated positively.
It should also be mentioned that due to the applied layer thicknesses of up to 50 mm – which can presumably be applied without any problems – it is possible to compensate for unevenness in the plaster substrate and to compensate for larger deviations from the alignment of the substrate with the plaster layer.

Dipl.-Ing Rolf Kaiser