

Lengheim Consulting und Entwicklung  
GmbH  
Bahnstraße 16  
2213 Bockfließ



Magistrat der Stadt Wien  
MAGISTRATSABTEILUNG 39  
Prüf-, Überwachungs- und  
Zertifizierungsstelle der Stadt Wien  
Standort: Rinnböckstraße 15  
1110 WIEN  
Tel.: (+43 1) 4000-8039  
Fax: (+43 1) 4000-99-8039  
E-Mail: post@ma39.wien.gv.at  
Homepage: www.ma39.wien.at



MA 39 – VFA 2019-0021.06

Vienna, 16<sup>th</sup> of April 2019

## Laboratory Report\*

concerning

### temperature measurement of wax-coated concrete- and wooden boards during cooling

- Applicant:** Lengheim Consulting und Entwicklung GmbH
- Ordering date:** 7<sup>th</sup> of January 2019
- Test materials:** Three coated pairs of concrete boards and three uncoated pairs of concrete boards (for comparison) out of the same charge  
Three coated pairs of wooden boards and three uncoated pairs of wooden boards (for comparison) out of the same charge
- Test program:** Measuring of surface- and air-temperatures during defined cooling down to environmental temperature
- Short abbreviation:** By cooling down the above described samples a tendency for more slightly cooling has been observed in favour of the coated boards (with adjusted wax-coating at the surface).

\*....English version of Laboratory Report MA 39-VFA 2019-0021.02 from 18<sup>th</sup> of February 2019

The report contains 6 pages  
and one appendix (13 pages).



## 1 General

The producing company of the thermal coating (according to the description of applicant so called: "wax - coating") applied for MA 39 to compare temperature cooling of coated and uncoated samples within a simple test.

Following a short discussion with the applicant simple qualitative random measurements of thermal properties of the samples described below (coated and uncoated) have been performed. Due to the applicant an easy derivable effect has been to be expected.

### Note:

The performed measurements are for scientific interest only and are not covered by specific standards. The measurements therefore serve to detect a first effect.

For simulation of a practical case concerted with the applicant a simple (not stationary) cooling-process has been examined. The quadratic sample-boards have been glued together as pairs and warmed up uniformly until 60°C within an oil-bath. Afterwards measurements of the cooling down process within laboratory atmosphere have been performed.

### 1.1 Standards, additional documents

/1/ Photographs of selected samples and measurement apparatus look at appendix.

/2/ EN 16012 Thermal insulation for buildings. Reflective insulation products. Determination of the declared thermal performance, look at appendix D (latest version).

## 2 Materials to be tested

On the 2<sup>th</sup> of January the following 12 sample pairs have been delivered at MA 39 by the applicant, compare also pictures in the appendix.

three pairs of boards of concrete uncoated  
three pairs of boards of concrete coated

three pairs of boards of wood uncoated  
three pairs of boards of wood coated

The coating has been adjusted due to the applicant (so called: "wax-coating", in German: "Wachsbeschichtung").

The following parameters of the coated and uncoated boards have been obtained.



sample	sample- pair- number	Size			mass 1. piece [g]	mass 2. piece [g]	middle density [kg/m <sup>3</sup> ]
		Length [mm]	Width [mm]	Thickness [mm]			
<b>wood</b> uncoated	1	100	100	56	170,80	170,38	304,63
	2*	100	100	56	169,64	169,92	303,18
	3	100	100	56	167,04	167,62	298,80
<b>wood</b> coated	1	100	100	60	199,95	199,19	332,62
	2	100	100	60	198,67	198,60	331,06
	3	100	100	60	198,39	198,29	330,57

sample	sample- pair- number	Size			mass 1. piece [g]	mass 2. piece [g]	middle density [kg/m <sup>3</sup> ]
		Length [mm]	Width [mm]	Thickness [mm]			
<b>concrete</b> uncoated	1	100	100	61	709,26	708,10	1161,77
	2	100	100	62	705,66	685,40	1130,94
	3	100	100	61	755,26	718,20	1207,75
<b>concrete</b> coated	1	101	104	63	762,10	759,72	1149,84
	2	101	102	63	728,20	725,66	1120,03
	3	102	104	64	745,04	772,00	1131,60

\*... Note: for this sample pair no cooling measurements have been carried out.

## 2 Test and results

### 2.1 Test conditions

#### 2.1.1 General

For the measurement of selected surface- and air temperatures calibrated thermocouples have been glued at the pairwise samples (concrete- and wooden boards) within the region of the common centre (measuring channel "CH03" glued at the common center of the quadratic contact areas of the sample pairs) and at the external areas, look at the appendix pages 1 and 2.

Additionally the air-temperatures have been measured at both external sides within a distance of approximately 1 cm.

The surface temperatures at the sample pairs (extern surfaces: measuring channels 2 and 4; inside at the centre between the glued sample pairs: measuring channel 3) and the air temperatures (extern at both sides at measuring positions 1 and 5) have been measured with thermocouples within a time interval of 10 seconds for a total constant time interval of exactly 40 minutes.



For better comparison of the results among the tested samples always the same thermocouples (and the same mounting/glue type) at the same according positions of the sample pairs have been used.

The sample pairs have been packed into foils and been heated to approximately 60 °C within an oil-bath. Afterwards the samples were removed out of the bath and the cooling down curves have been determined.

The air temperature (laboratory air temperature) has been approximately kept constant during the measuring periods by air conditioning.

## 2.2 Cooling down to environmental air temperature of laboratory

The cooling down process of the samples followed directly after the thermal approximation within the oil-bath by moving the samples out of the bath and by consecutive heat transfer with the environmental air temperature (room temperature) of the laboratory. For according cooling down graphs look at the appendix.

## 2.3 Testing time

The total testing period lasted from 31<sup>th</sup> of December 2018 until 7<sup>th</sup> of January 2019.

## 2.4 Measurement results

### 2.4.1 Differences of middle sample temperatures

After thermal approximation within the oil-bath up to 60°C the pairwise glued and foil-wrapped samples were moved out of the bath and the referring cooling down graphs have been determined, look at the appendix.

By comparing same time periods of exact 40 min the following temperatures (start- and end-temperatures) have been obtained in the case of uncoated and wax-coated sample pairs:

Sample-type:	channels:	Ch01 [°C]	Ch02 [°C]	Ch03 [°C]	Ch04 [°C]	Ch05 [°C]
<b>wood 1 uncoated</b>	Start	25,3	44,9	58,4	43,8	24,5
	End	24,7	31,1	41,1	30,7	24,3
<b>wood 1 coated</b>	Start	26,2	45,1	59,5	46,9	26,0
	End	24,8	32,5	45,0	32,2	24,6

Middle-temperature difference:	$\Delta T \approx$ <b>2,0 K</b>
--------------------------------	---------------------------------



Sample-type:	channels:	Ch01 [°C]	Ch02 [°C]	Ch03 [°C]	Ch04 [°C]	Ch05 [°C]
<b>wood 2 coated</b>	Start	25,3	44,1	59,7	47,3	24,9
	End	24,6	31,6	44,4	31,7	24,8

Sample-type:	channels:	Ch01 [°C]	Ch02 [°C]	Ch03 [°C]	Ch04 [°C]	Ch05 [°C]
<b>wood 3 uncoated</b>	Start	25,5	44,5	59,7	44,4	25,2
	End	24,8	30,7	40,8	30,5	24,2
<b>wood 3 coated</b>	Start	27,2	47,2	59,8	46,7	25,8
	End	25,9	32,6	44,7	32,4	26,2

Middle-temperature difference:	$\Delta T \approx$ <b>2,1</b> K
--------------------------------	---------------------------------

Sample-type:	channels:	Ch01 [°C]	Ch02 [°C]	Ch03 [°C]	Ch04 [°C]	Ch05 [°C]
<b>concrete 1 uncoated</b>	Start	24,6	55,3	60,4	56,1	23,9
	End	25,3	37,9	39,6	38,2	24,7
<b>concrete 1 coated</b>	Start	24,7	55,1	60,0	54,5	25,4
	End	25,6	38,9	40,4	38,7	25,0

Middle-temperature difference:	$\Delta T \approx$ <b>1,1</b> K
--------------------------------	---------------------------------

Sample-type:	channels:	Ch01 [°C]	Ch02 [°C]	Ch03 [°C]	Ch04 [°C]	Ch05 [°C]
<b>concrete 2 uncoated</b>	Start	25,4	55,2	60,1	55,8	24,3
	End	25,1	37,6	39,3	38,1	24,8
<b>concrete 2 coated</b>	Start	24,3	54,8	60,2	54,6	24,4
	End	24,8	38,6	40,4	38,7	25,1

Middle-temperature difference:	$\Delta T \approx$ <b>1,0</b> K
--------------------------------	---------------------------------

Sample-type:	channels:	Ch01 [°C]	Ch02 [°C]	Ch03 [°C]	Ch04 [°C]	Ch05 [°C]
<b>concrete 3 uncoated</b>	Start	24,8	54,4	59,1	54,7	24,4
	End	24,8	37,6	38,9	37,9	25,4
<b>concrete 3 coated</b>	Start	24,9	55,2	60,1	55,8	24,6
	End	25,2	39,3	40,8	39,4	26,0

Middle-temperature difference:	$\Delta T \approx$ <b>0,9 K</b>
--------------------------------	---------------------------------

Small differences within starting conditions concerning air temperatures and slightly different temperature assimilations within the oil-bath have been taken into account by averaging.

### 2.4.2 Differences of results

Comparing wax-coated with uncoated samples after the same cooling down period for all samples of exact 40 min a tendency to slightly higher middle temperatures (thermocouple position 3 – middle centered region of quadratic glueing area between the sample pairs) in favour of the wax-coated samples has been obtained.

All wax-coated samples therefore showed a tendency for a slower cooling down rate, respectively slower cooling-off-rate.

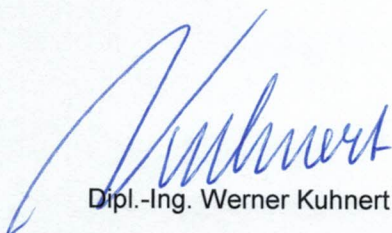
### 3 Conclusion


As described above under the chosen conditions a clear tendency for a more slightly cooling down process (slower cooling-off) concerning the wax-coated boards has been obtained.

Technical official:

Head of Laboratory:

Head of the Testing and Inspection  
Center and Certification Body

  
Dipl.-Ing. Werner Kuhnert

  
Dipl.-Ing. Dieter Werner MSc  
Oberstadtbaurat

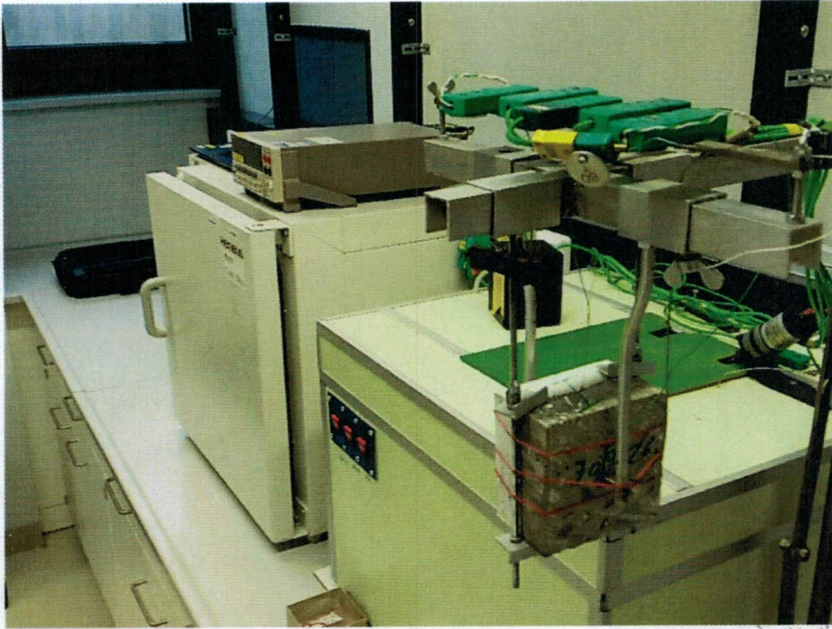
  
Dipl.-Ing. Georg Pommer  
Senatsrat





### Cooling down test for uncoated sample-pair of concrete 1:

Foto Nr. 1



**uncoated pair of concrete 1**

view:

**Temperature measurement positions:**

Three surface-thermocouples:  
positions: 2, 3 (middle), 4

Two air-thermocouples: (either adjusted 10 mm in front or behind the sample-surfaces):  
positions: 1, 5  
for environmental air temperatures.

### Cooling down test for coated sample-pair of concrete 1:

Foto Nr. 2



**Coated pair of concrete 1**

view:

**Temperature measurement positions:**

Three surface-thermocouples:  
positions: 2, 3 (middle), 4

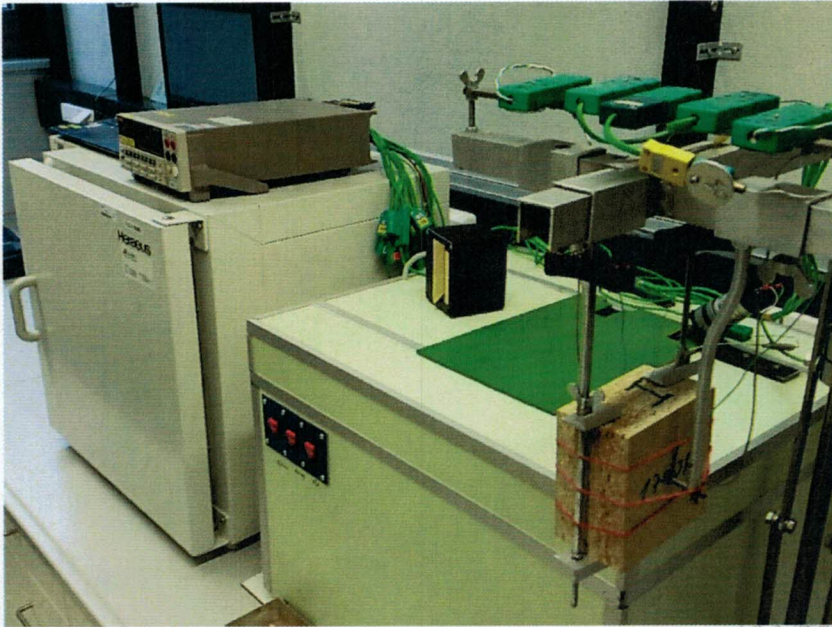
Two air-thermocouples: (either adjusted 10 mm in front or behind the sample-surfaces):  
positions: 1, 5  
for environmental air temperatures.





### Cooling down test for uncoated sample-pair wood 1:

Foto Nr. 1



#### Uncoated pair of wood 1

view:

#### Temperature measurement positions:

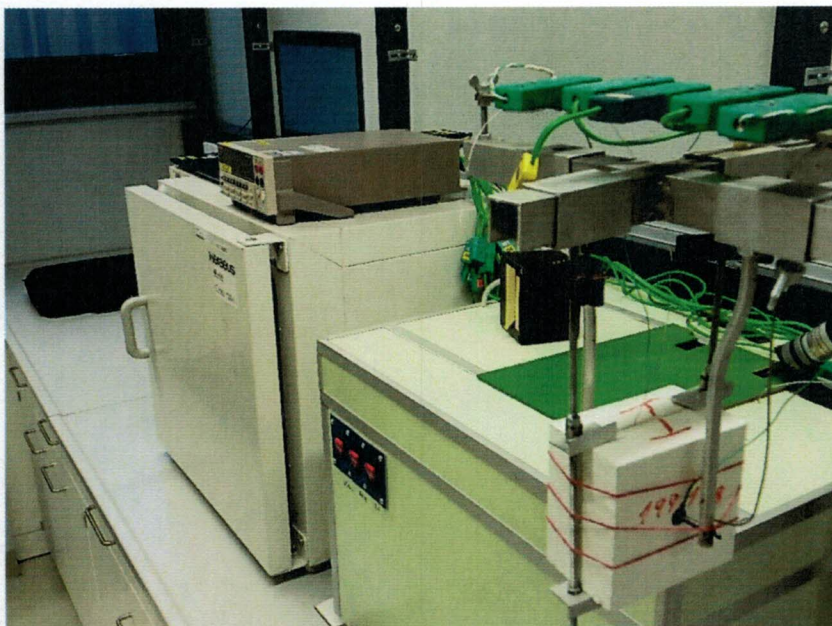
Three surface-thermocouples:  
positions: 2, 3 (middle), 4

Two air-thermocouples: (either  
adjusted 10 mm in front or  
behind the sample-surfaces):  
positions: 1, 5  
for environmental air  
temperatures.



### Cooling down test for coated sample-pair wood 1:

Foto Nr. 2



#### Coated pair of wood 1

view:

#### Temperature measurement positions:

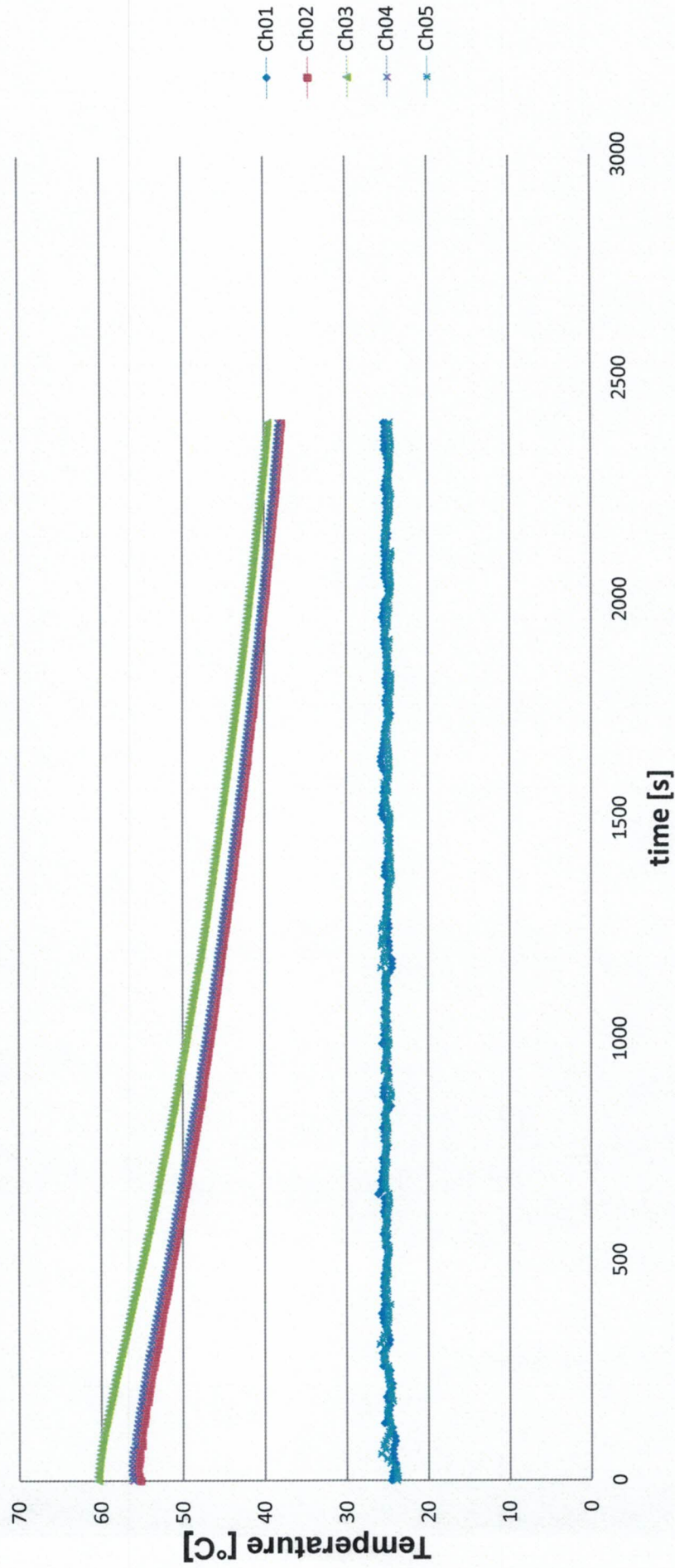
Three surface-thermocouples:  
positions: 2, 3 (middle), 4

Two air-thermocouples: (either  
adjusted 10 mm in front or  
behind the sample-surfaces):  
positions: 1, 5  
for environmental air  
temperatures.

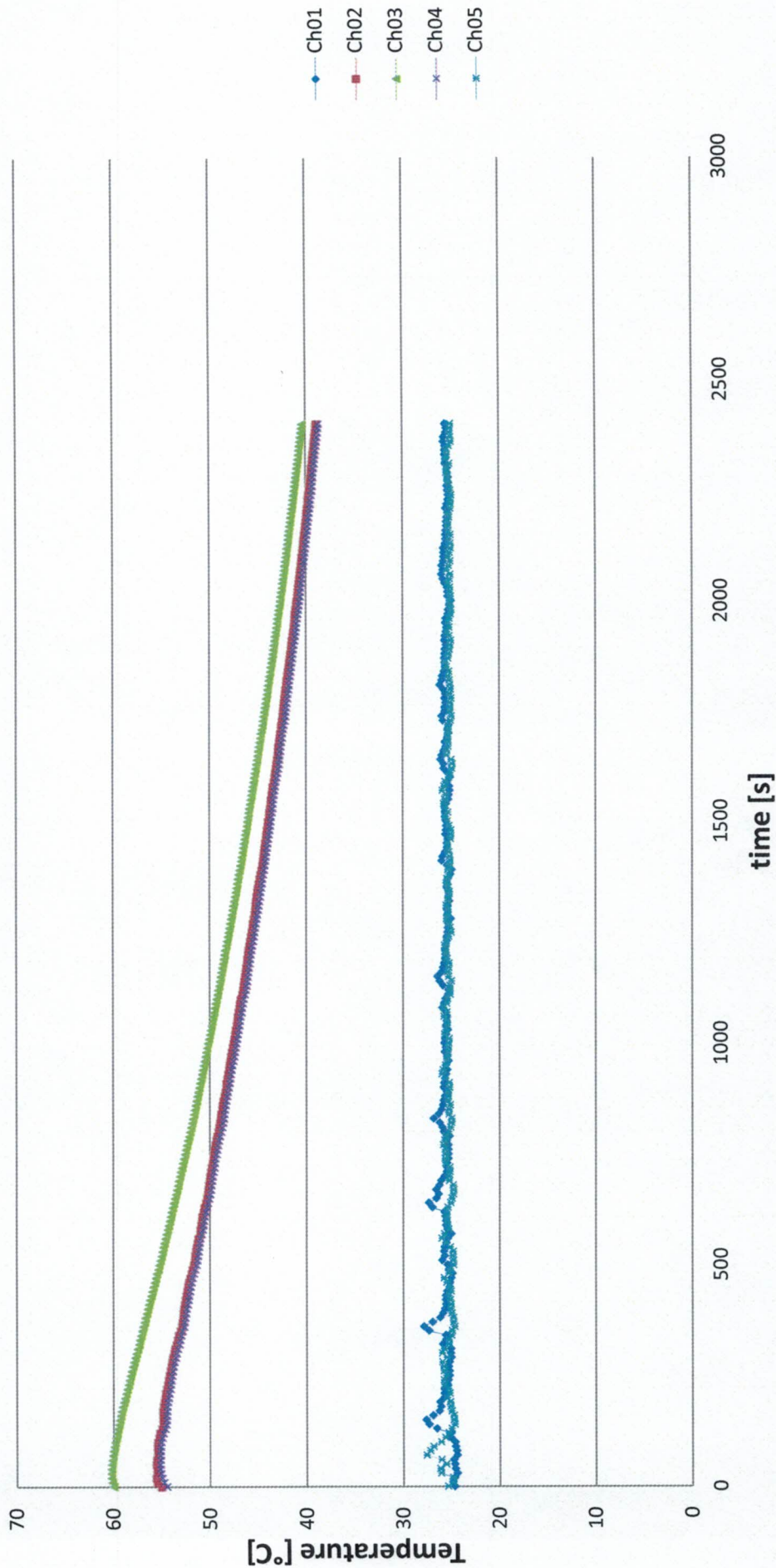




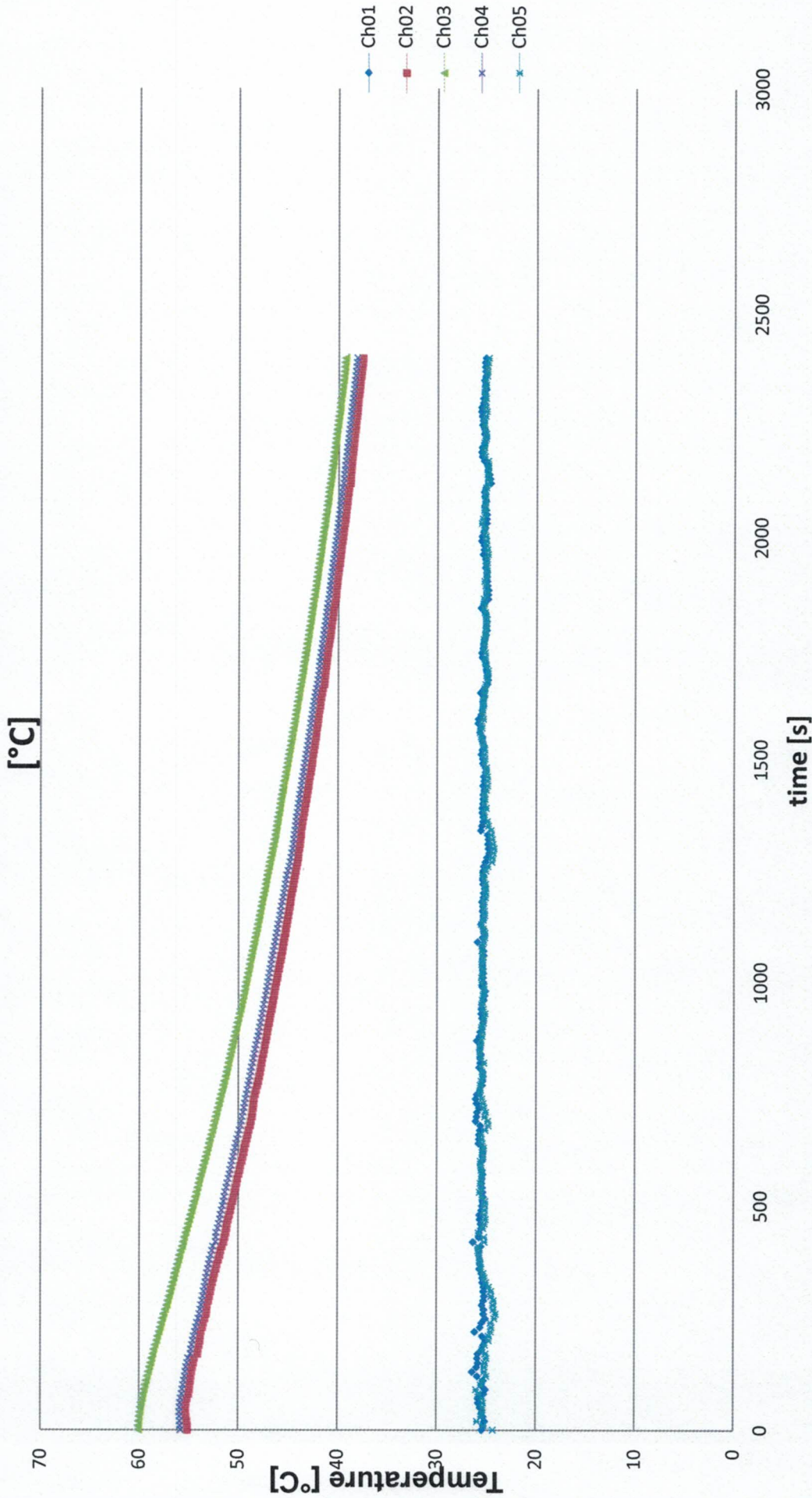
### Temperature\_2019\_01\_04\_08\_58\_01 cooling down concrete\_1 uncoated [°C]



# Temperature\_2019\_01\_04\_10\_17\_42\_cooling down\_concrete 1\_coated



### Temperature\_2019\_01\_03\_09\_05\_57 cooling down \_concrete 2\_uncoated



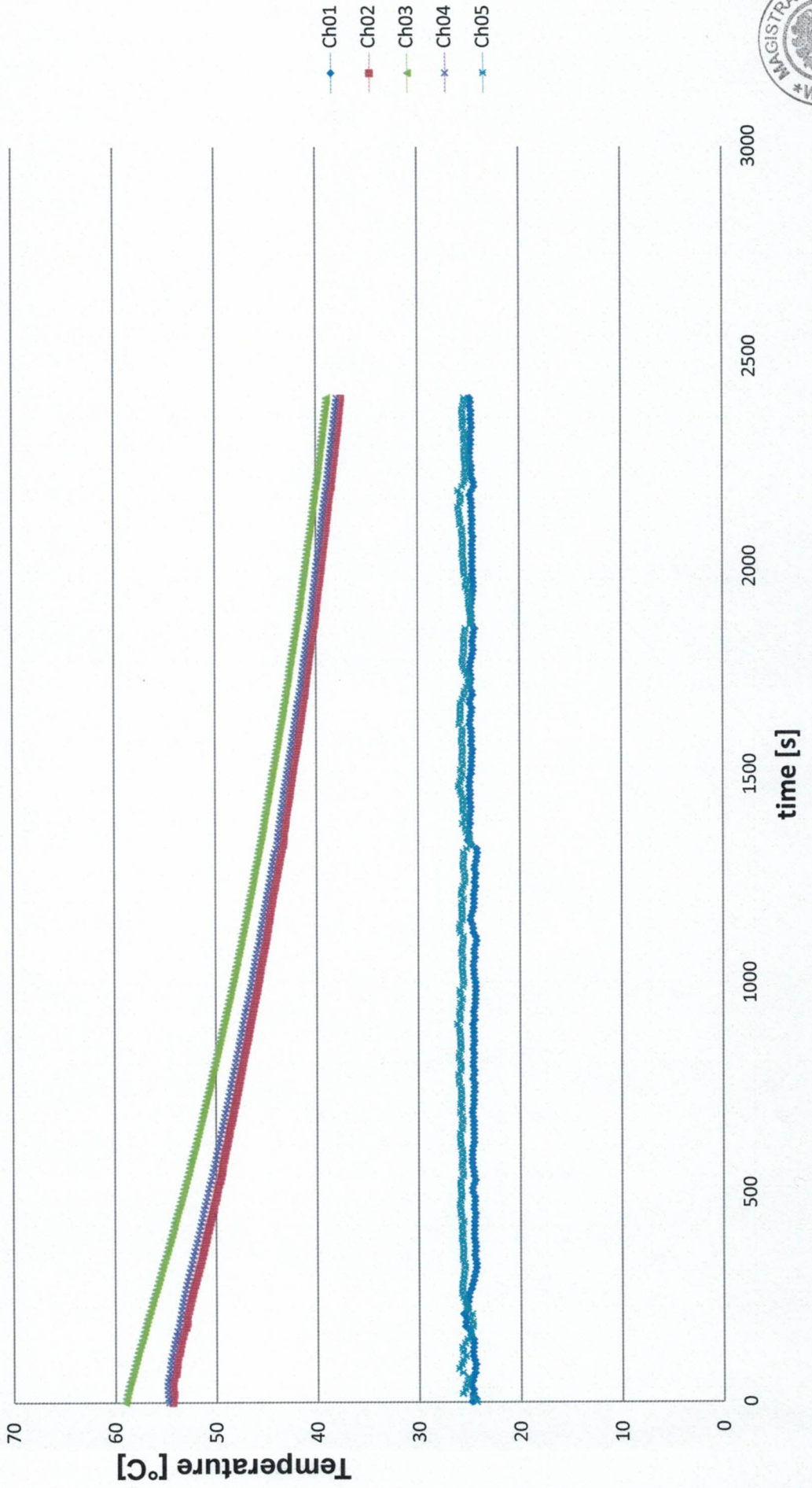
### Temperature\_2019\_01\_03\_13\_36\_04\_cooling down\_concrete 2\_coated

[°C]



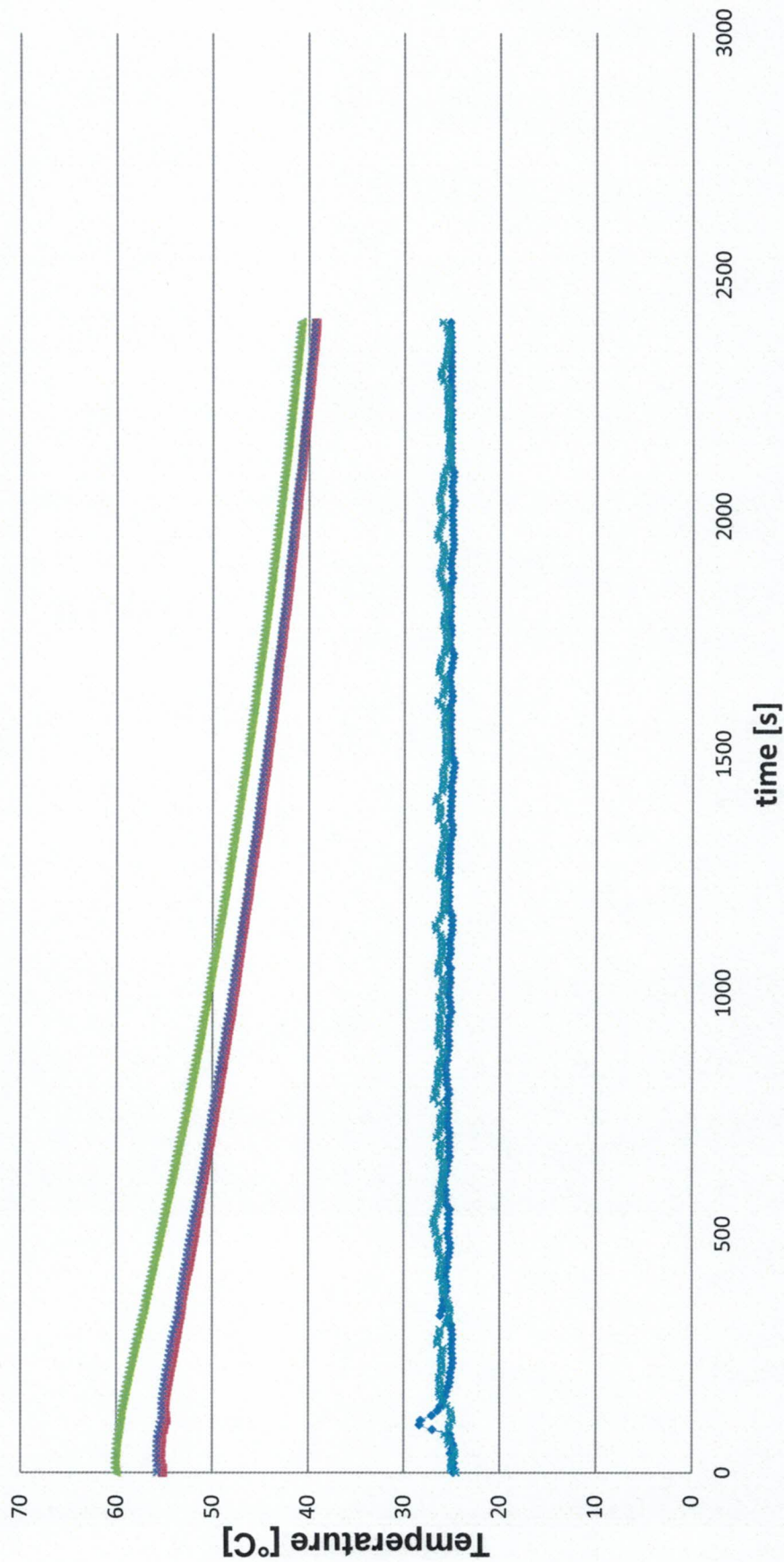
### Temperature\_2019-01\_03\_09\_51\_35\_cooling down\_concrete 3\_uncoated

[°C]

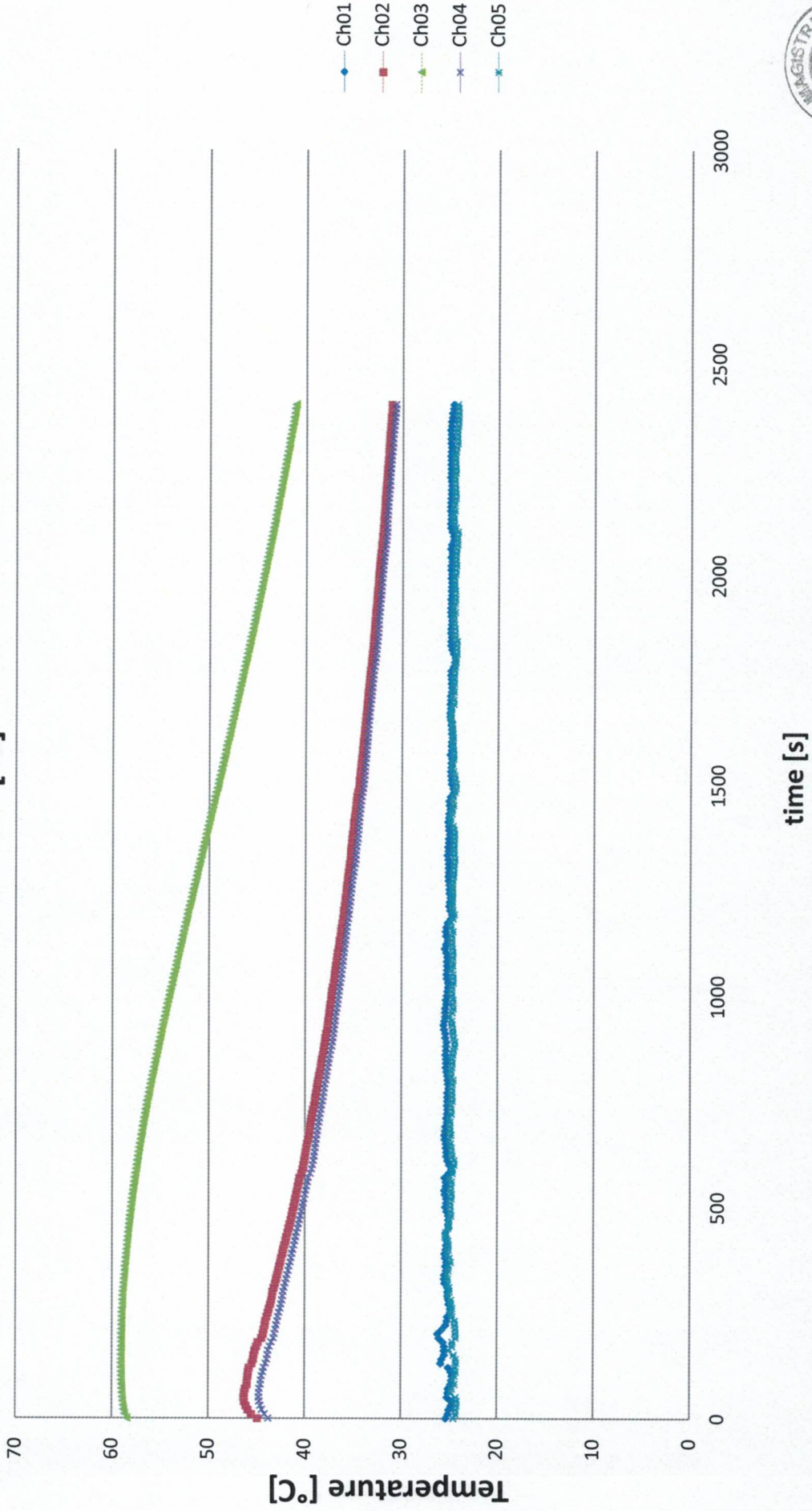


### Temperature\_2019\_01\_03\_14\_21\_28\_cooling down\_concrete 3\_coated

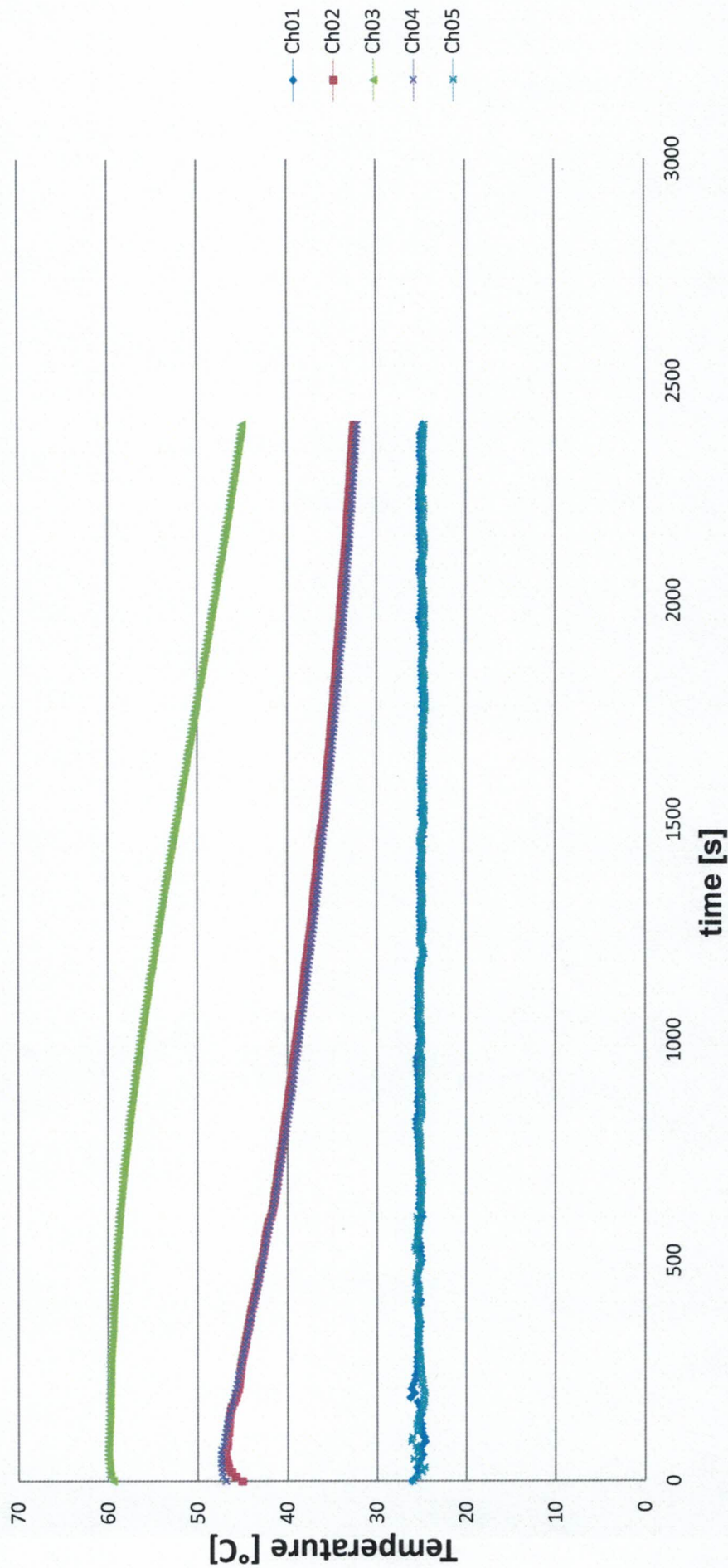
[°C]



# Temperature\_2019\_01\_04\_12\_02\_38\_cooling down\_wood\_1 uncoated

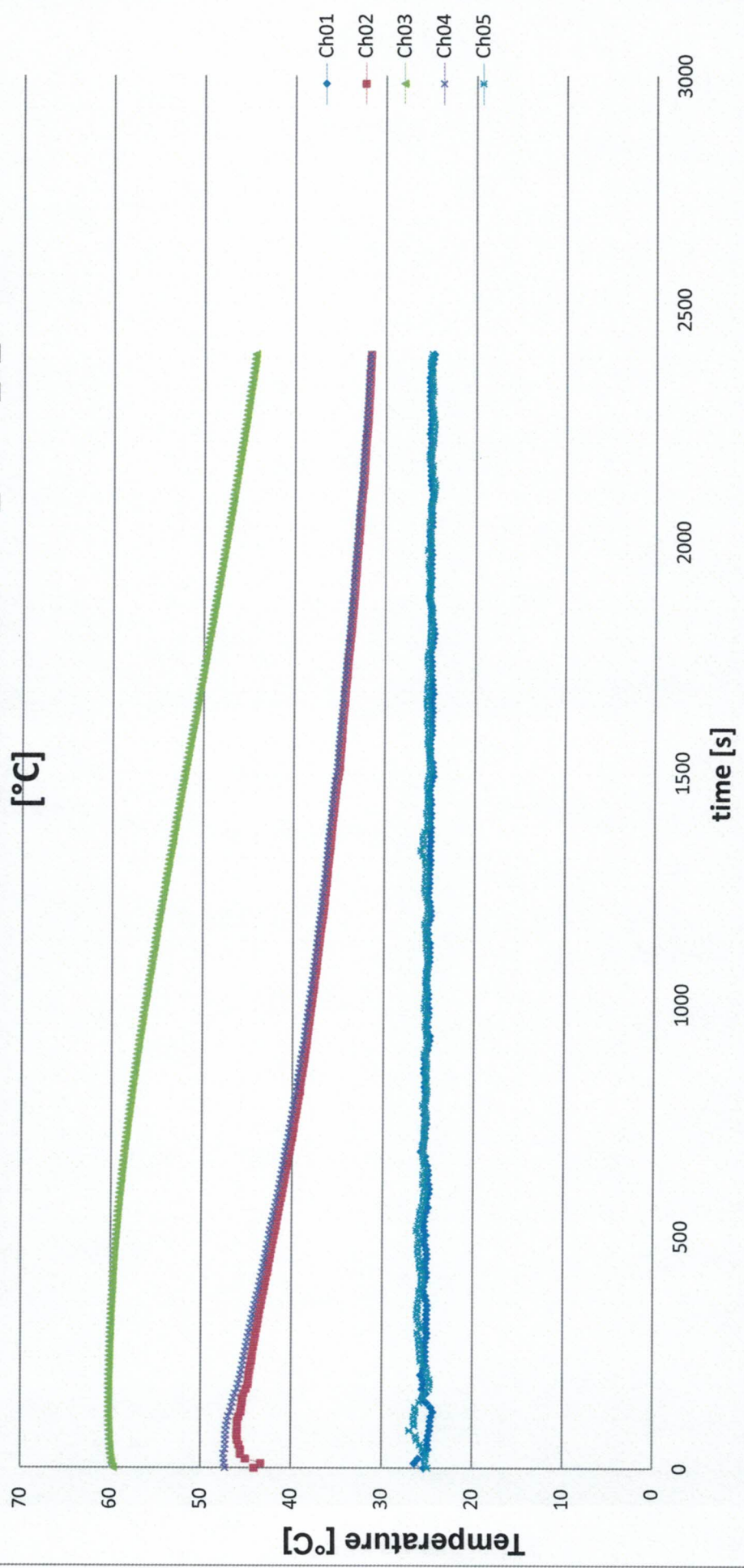


# Temperature\_2019\_01\_04\_54\_51\_cooling down\_wood\_1\_coated



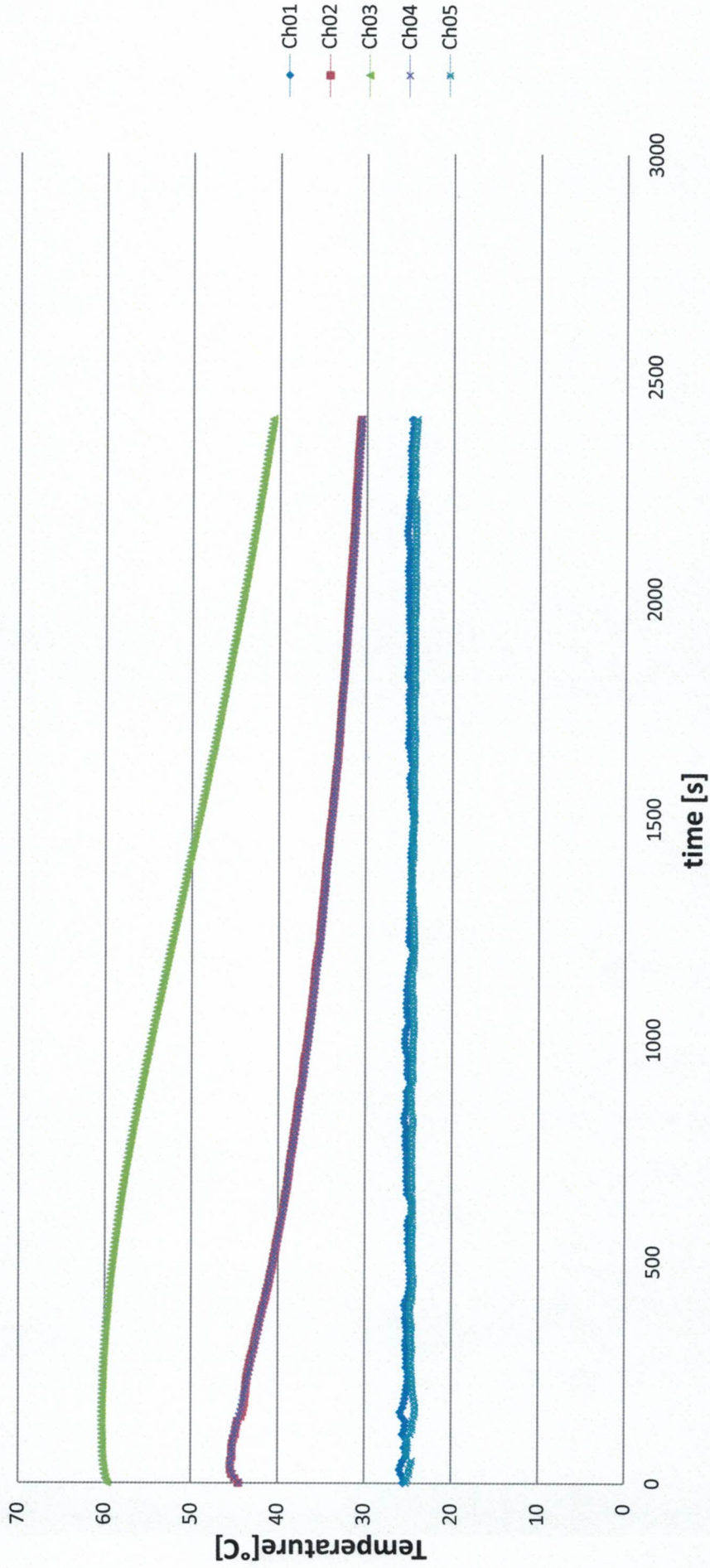


### Temperature\_2019-01-04\_13\_49\_48\_cooling down\_wood\_2\_coated



# Temperature\_2019\_01\_04\_12\_47\_38\_cooling down\_wood 3-uncoated

Temperature [°C]



### Temperature\_2019\_01\_02\_12\_32\_41\_cooling down\_wood\_3\_coated

[°C]

