Linkam TS1500 micro furnace with capillary heater
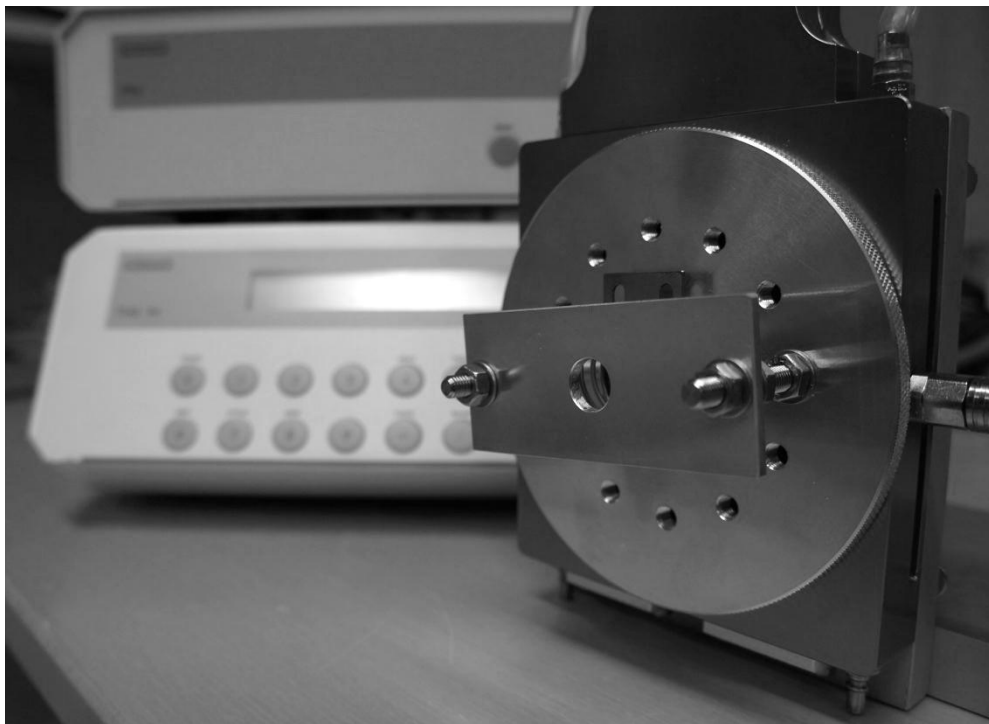
Contents

Introduction

The Linkam furnace is a high temperature heating-coil micro-furnace, operating in normal atmosphere. It has an integrated platinum-10% rhodium/platinum thermocouple inside which reads the temperature of the furnace to ± 1°C accuracy.

To be able to heat larger samples than what the furnace was intended for, a 25 gram copper block can be inserted into the furnace. The copper block is fixed with a clamp and a spring to lower the heat conduction to the surroundings. Figure 1 shows the complete set of parts with the Linkam furnace, base lid, sliding bracket and a spring connected to the copper block, and a mounting bracket. Because most of the copper block is situated outside the furnace the temperature of the copper block will be lower than the set-point of the furnace. The response is also lower. Different calibration ramps are found in the appendix.

With working temperatures of 100 °C, or higher, the Linkam furnace needs to be connected to water cooling.

Assembly

The two support screws are fastened to the base lid, which is then gently screwed onto the Linkam furnace (Figure 2). The sliding bracket is then fastened together with the spring to the copper block (Figure 2). Finally the mounting bracket is gently lowered on top of the spring, and fastened with the two support screws (Figure 3). Figure 4 show the complete setup mounted in the I911-4 SAXS-station at MAX-Lab.
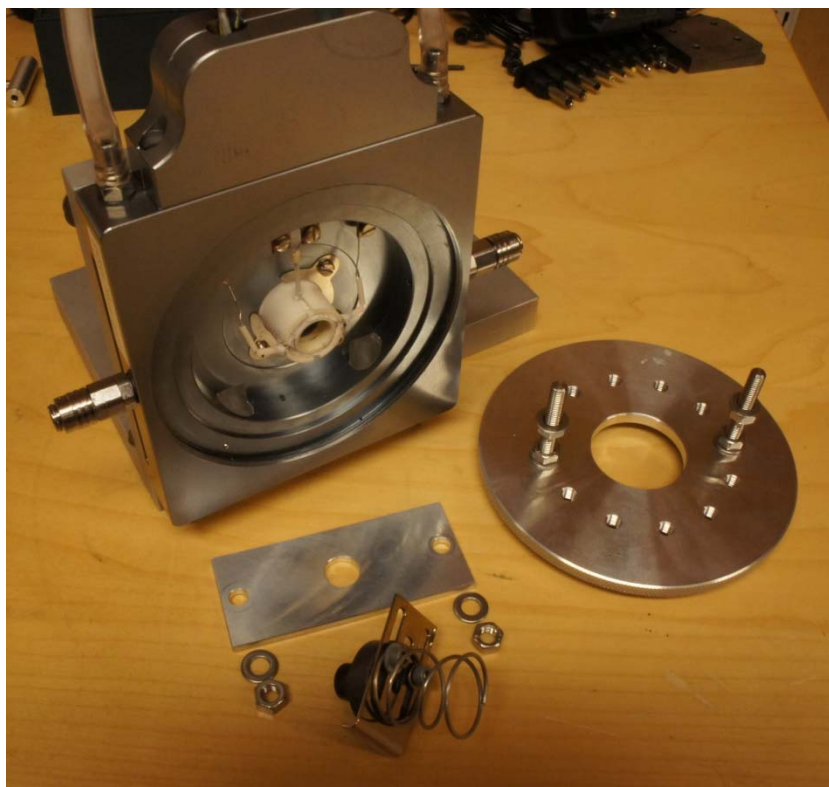
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Figure 1: The Linkam furnace with the copper block assembly.

Figure 2: The copper block is inserted into the furnace.

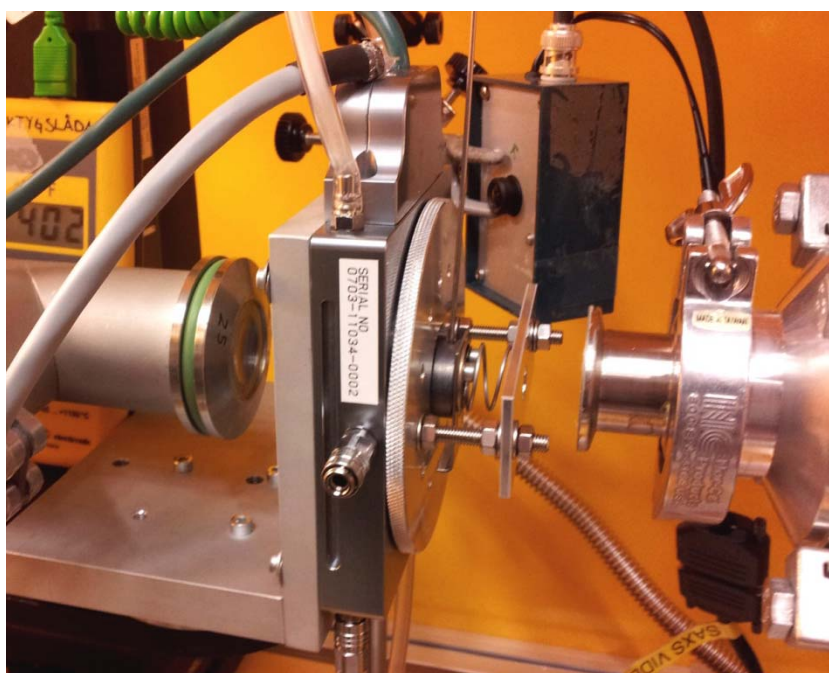**Figure 3: Mounting bracket securing the copper block to the Linkam furnace.**

Figure 4: The modified Linkam furnace mounted in the I911-4 SAXS-station.

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Specifications

Sample Size

The copper block can hold round capillaries up to 2 mm diameter. The position of the capillaries can be adjusted 12 mm with the sliding bracket connected to the copper block.

Heating/cooling rate

The maximum heating rate should never exceed 30 °C/min. The calibration is done with a heating rate of 30 °C/min. Maximum cooling rate should never exceed 10 °C/min to prevent damage to the furnace.

Maximum temperature

The furnace with copper block has been tested to 500 °C. At these temperatures the copper block oxidizes readily, and needs to be cleaned with sand paper after cooling. Any oxide will lead to lower heat conductivity between the base of the copper block and the bottom of the furnace.

Programming

The controller can hold up to 32 individual programs. They are run automatically in increasing order, always starting with program 1. A heating/cooling rate of zero will indicate the end of a profile.

Create/modify a program

Press RAMP and enter a number from 1-32. To change the heating/cooling rate, press RATE and enter a number between 0.1 and 30.

To change the temperature set-point, press LIMIT and enter a number between 0.1 and 500. 500 °C is the maximum temperature the modified furnace has been tested to.

To change the dwell time, press TIME and enter the desired time in minutes. The program will move to the next segment when the desired time has elapsed.

To save the program, press ENTER. The controller will then go back to the former activity; either the start screen, or back to the program which is running.

Start/stopping a program

To start the programs, press START. Pressing EXIT will stop the programs. To save the changes to the programs, press ENTER, or press EXIT one more time to discard any changes.

NB! If the furnace has a temperature of more than 300 °C while stopping, a cooling program with a cooling rate of 10 °C/min should be used to prevent damage to the furnace. For example if program 1 is running with a set-point of 350 °C, program 2 should be programmed like this: RATE of 10 °C/min, TEMP of 25 °C, and LIMIT 0 min.
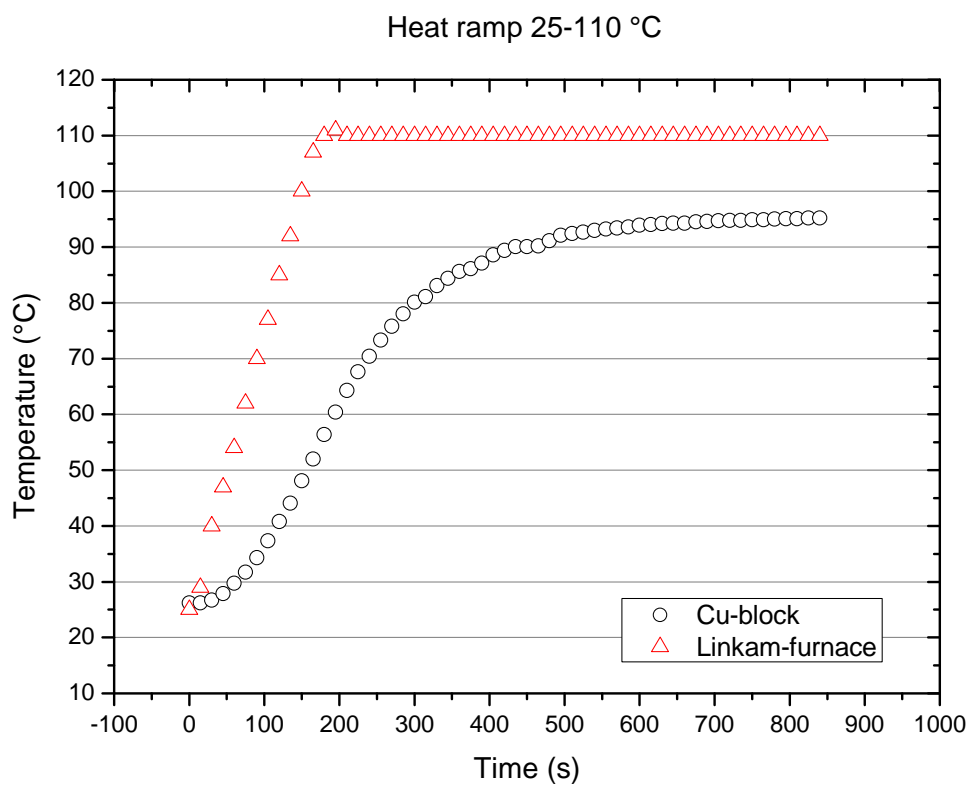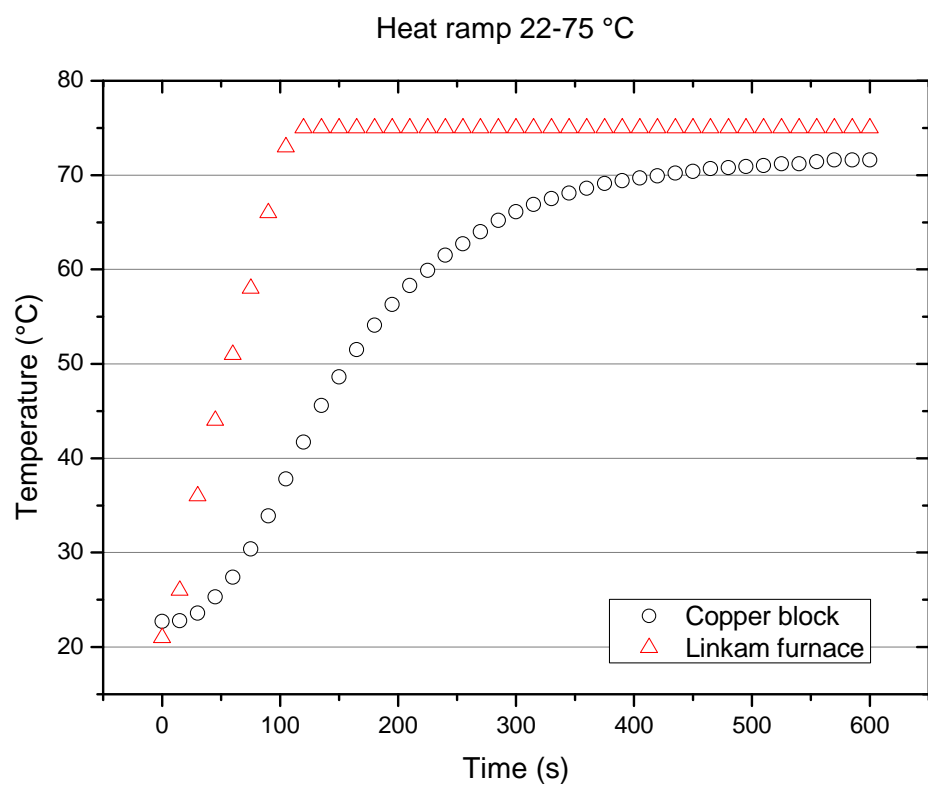
Modify an executing program

A program can be changed while running. Press RATE to change the rate, press LIMIT to change the temperature set-point, or press TIME to change the dwell time. If the time is changed to zero, the controller will jump to the next program in the sequence, e.g. from program 1 to program 2.
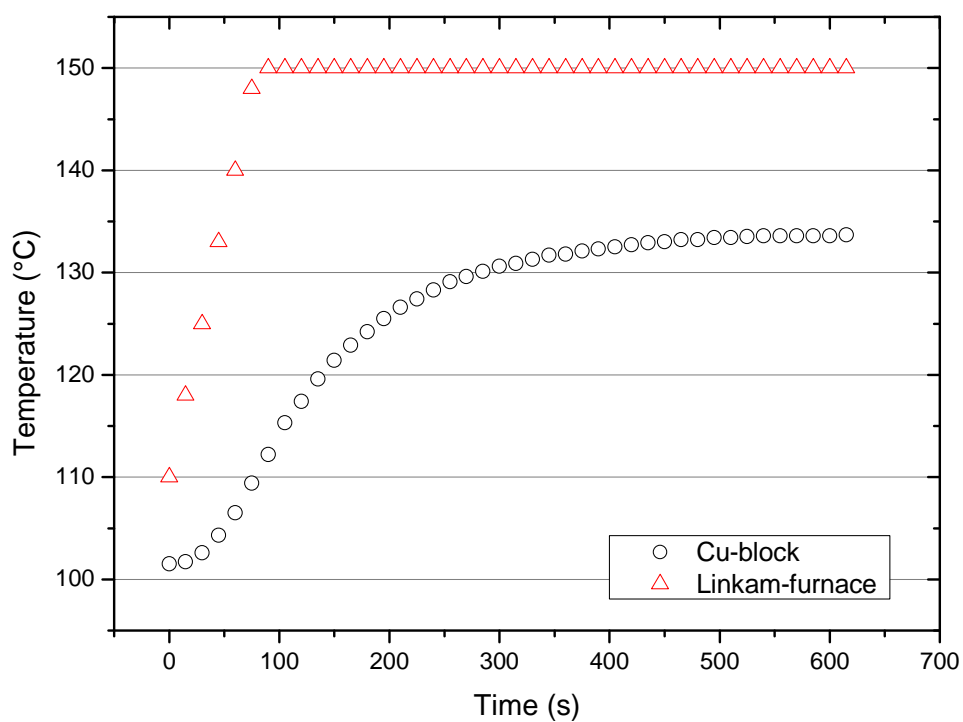
To change another program while running, press RAMP and enter the desired program number. When finished changing the RATE, LIMIT and TIME parameters, press ENTER to save the changes.
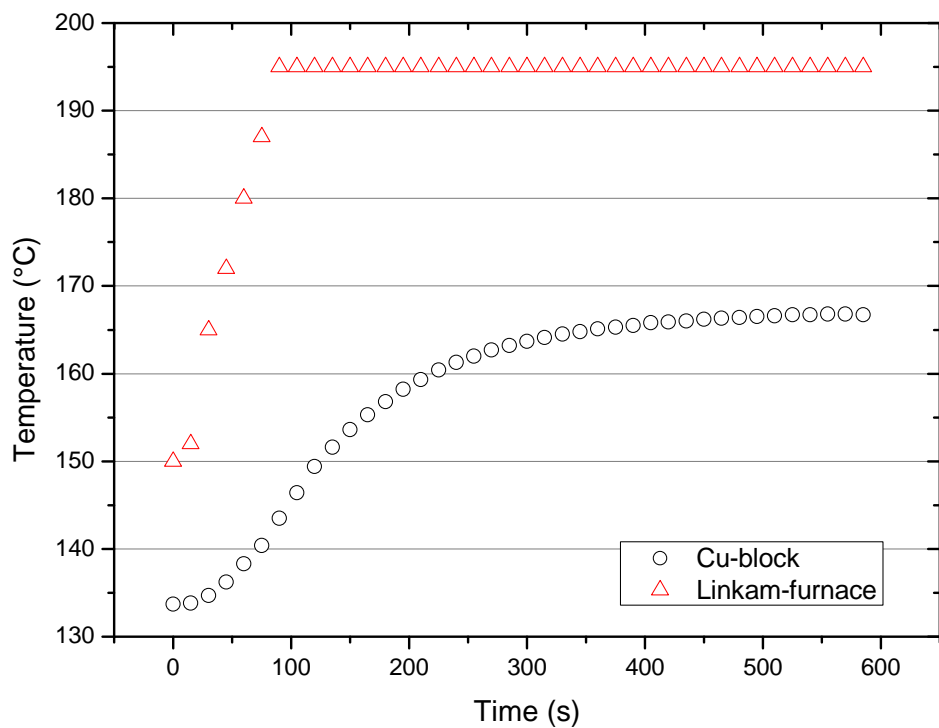
Appendix

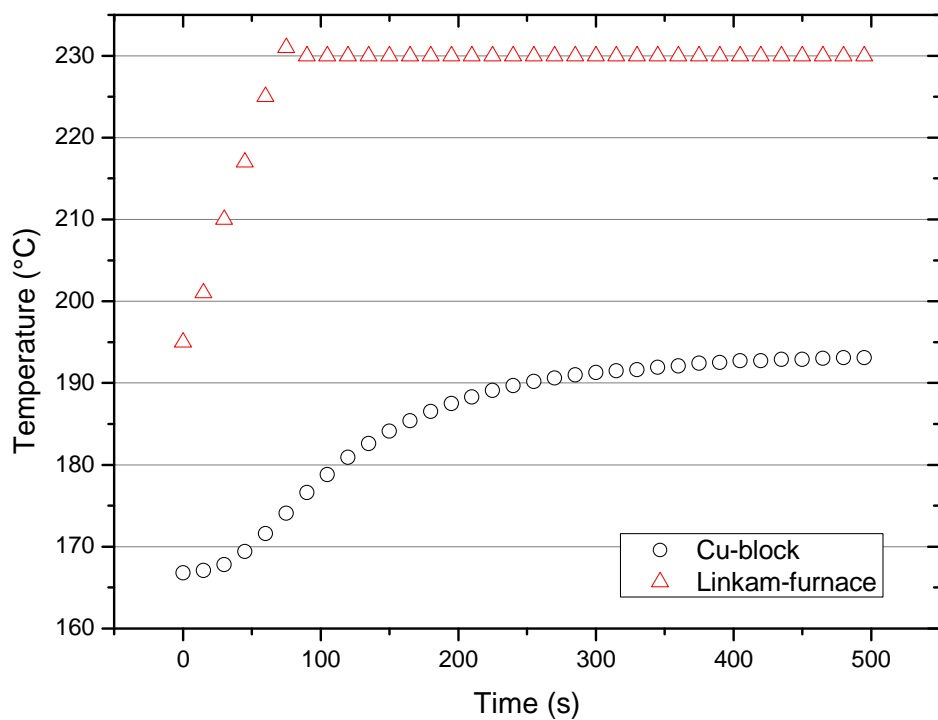## Temperature calibration performed with a heating rate of 30 °C/min.
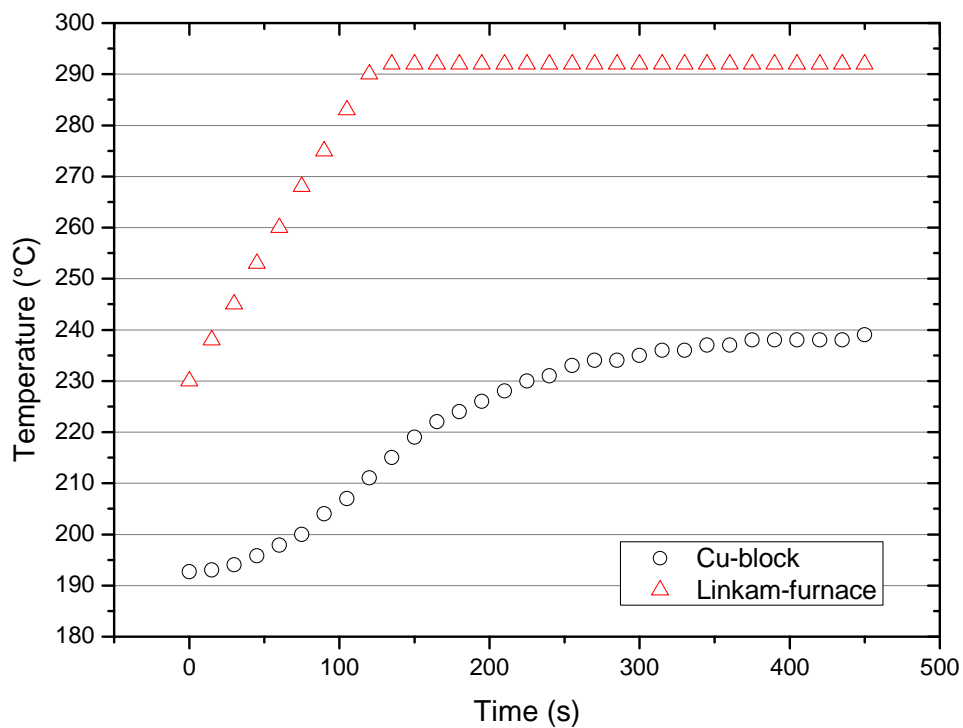
Heat ramp 22-75 °C

Heat ramp 25-110 °C

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Heat ramp 110-150 °C

Heat ramp 150-195 °C

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Heat ramp 195-230C

Heat ramp 230-295 °C

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Heat ramp 295-325 °C
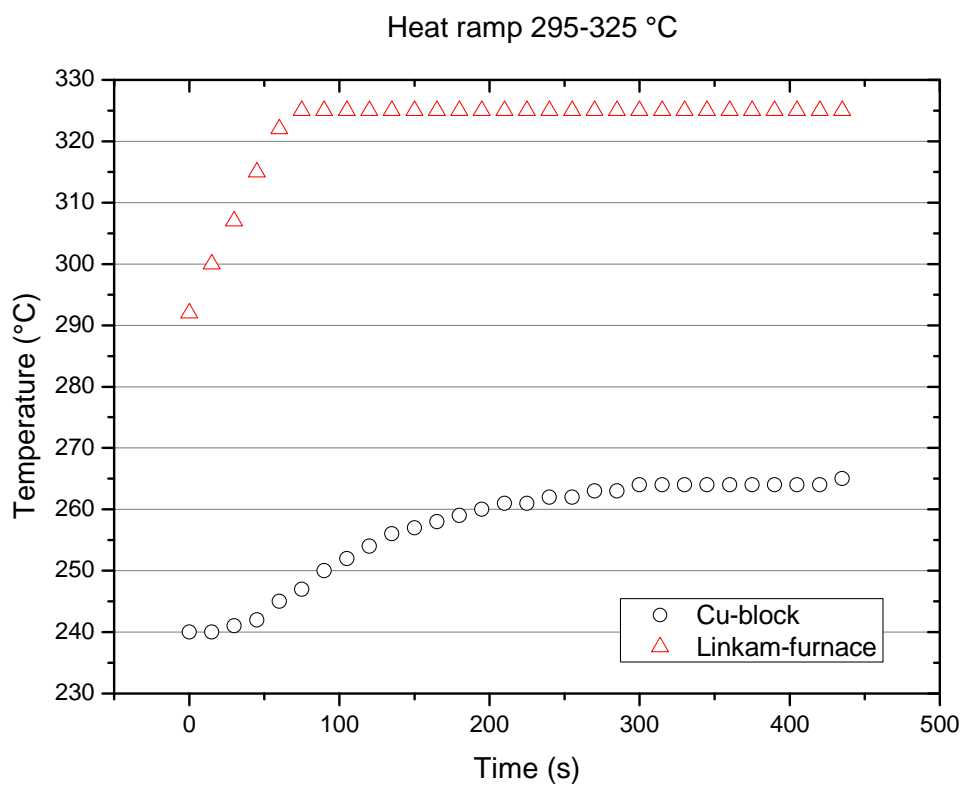

Heat ramp 325-400 °C

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Heat ramp 25-500 °C, 30°C/min
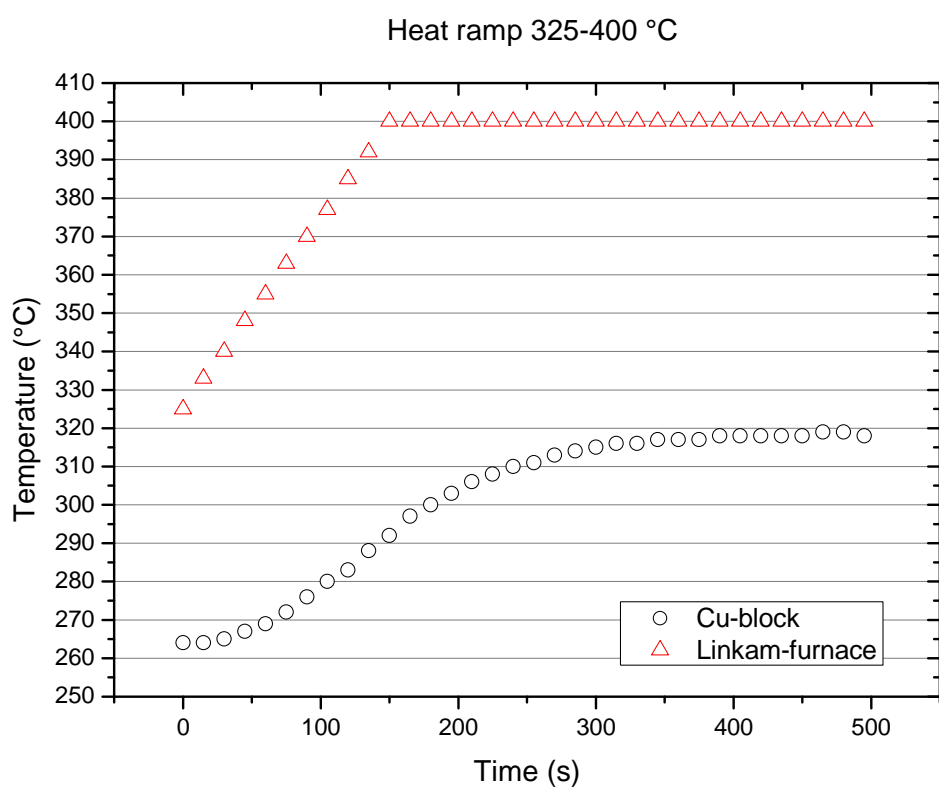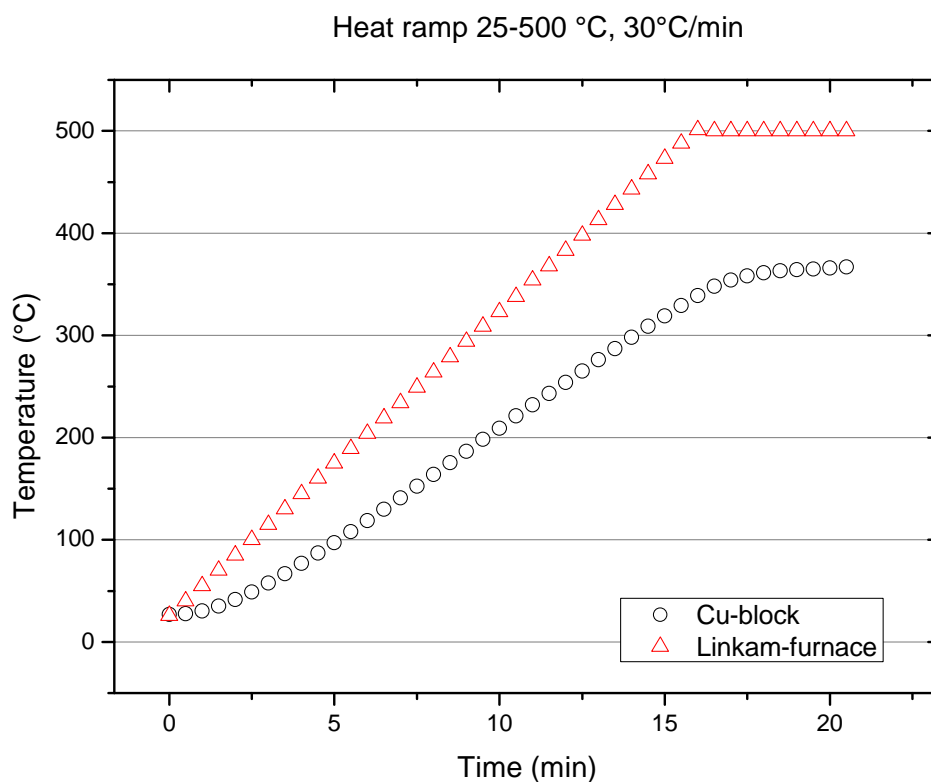
Temperature calibration performed with a heating rate of 10 °C/min.

Heat ramp 22-150 °C, 10°C/min

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