

# Lighter temperature, lifetime and pre-light times

## Cerulean, Milton Keynes, UK

### Introduction

It is known that the temperature of lighting of a combustible cigarette in a smoking machine can influence the amount of CO produced in the first few puffs.

There is a general understanding that the lighters employed in a smoking machine will have a lifetime and require periodic replacement. The period of replacement is not specified by the manufacturer and so it is a matter of judgement when best to replace the lighters. The mechanisms that reduce or extend lighter life are not well known.

What is even less well known is that the pre-light time, a variable in the settings of a smoking machine, in part determines the temperature of lighting.

On a standard linear smoking machine, such as the SM450 series provided by Cerulean, the lighting system is powered by a constant voltage supply. There is a pre-light time, which can be selected by the user, that determines the time between providing voltage to the lighters and the audible signal to start lighting.

The pre-light allows time for the lighters to become hot before lighting. The relationship between the pre-light time, lighter age and lighter surface temperature gives insight into the lighting conditions for analytical smoking.

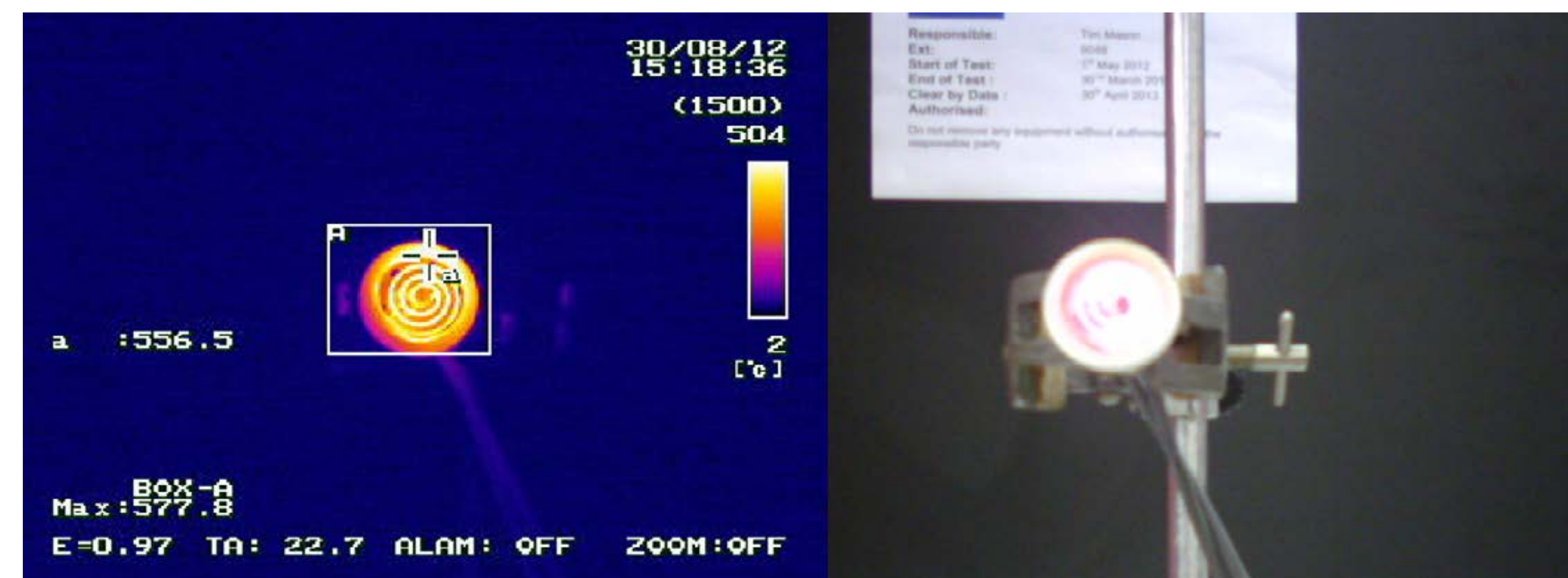


Figure 1: Pseudo colour and standard image of the heater element under test

### Experimental

Due to the nature of the lighting coils on a smoking machine and the power supply used, the surface temperature of the lighters increase with the time the voltage is applied.

The challenge experimentally is in devising a method that allows measurement of coil temperature.

Using a thermal imaging video camera a temperature “map” of the coil surface can be obtained (figure 1). This highlights any hotspots or cold spots which could not be achieved with more conventional measurement such as a thermocouple fixed to a point on the heater surface.

Plotting the change in temperature as voltage is applied shows a distinct curve to the coil surface temperature, the difference between a pre-light time of 30 seconds and 60 seconds being some 100°C.

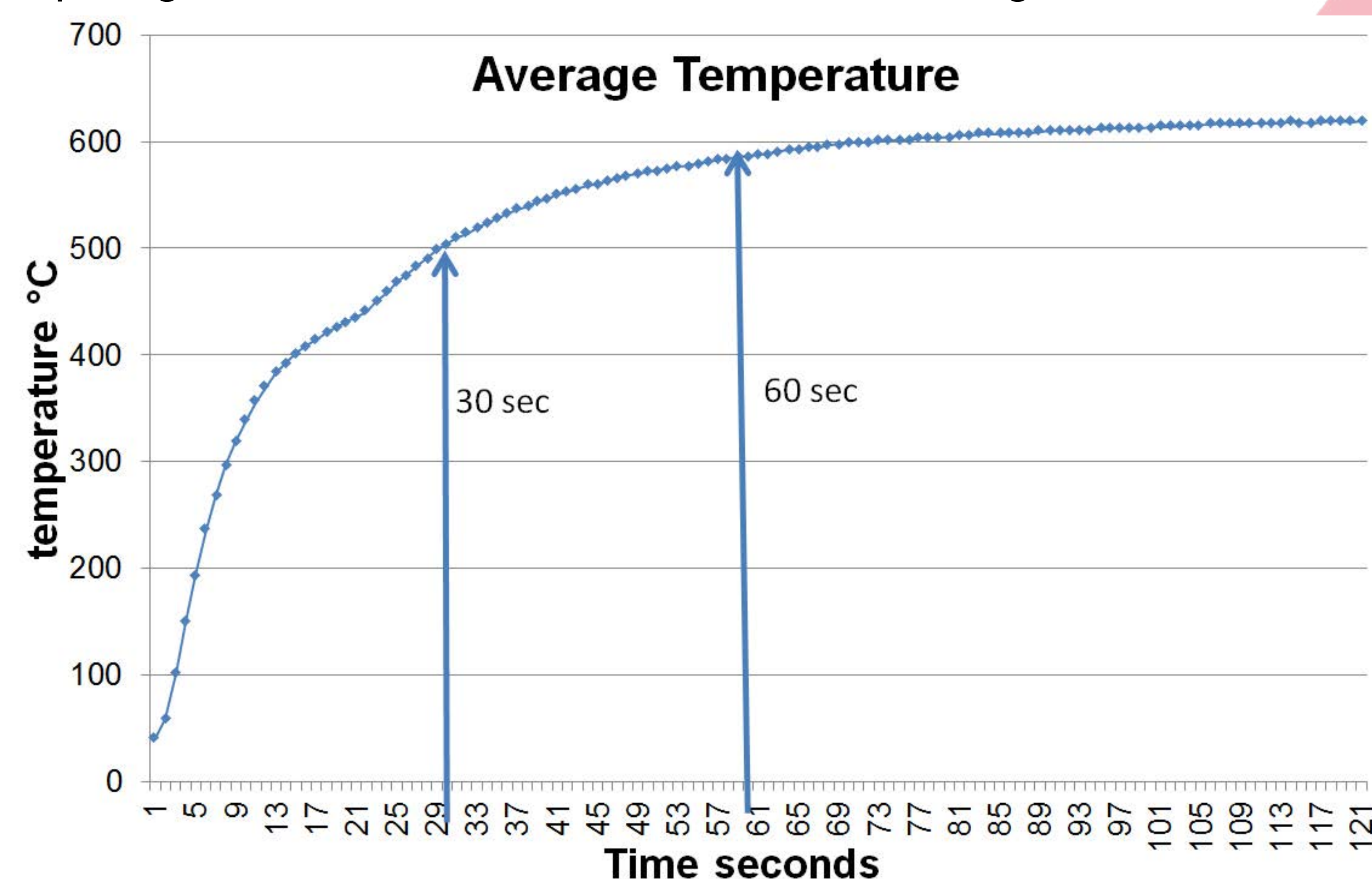


Figure 2: Plot of changing heater surface temperature with pre-light time

The surface temperature of a lighter is also a function of the “newness” of the lighter. Figure 3 shows the thermal images of the same coil separated by 5 cycles of 60 second pre-light. A distinct drop in surface temperature of 29°C is shown.

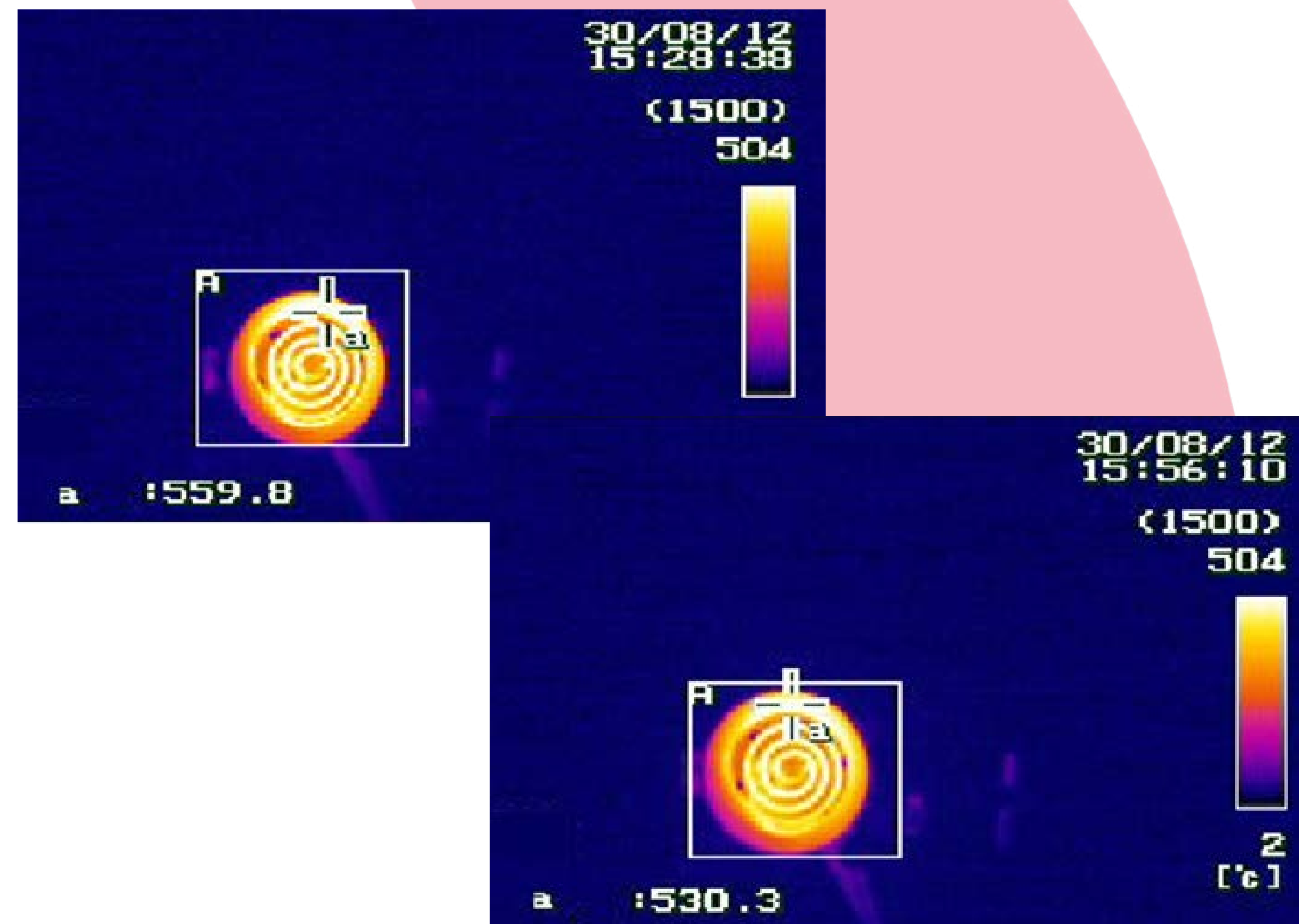


Figure 3: Pseudo colour images of lighter surface temperature; 60 second pre-light time, 10 cycles apart

Figure 4 shows the surface temperature change of typical coils with repeated use when a 30 second and 60 second pre-light time is used. It can be seen that there is an initial 80°C difference in surface temperature but the 60 second pre-light surface temperature decays twice as rapidly as the 30 second pre-light temperature.

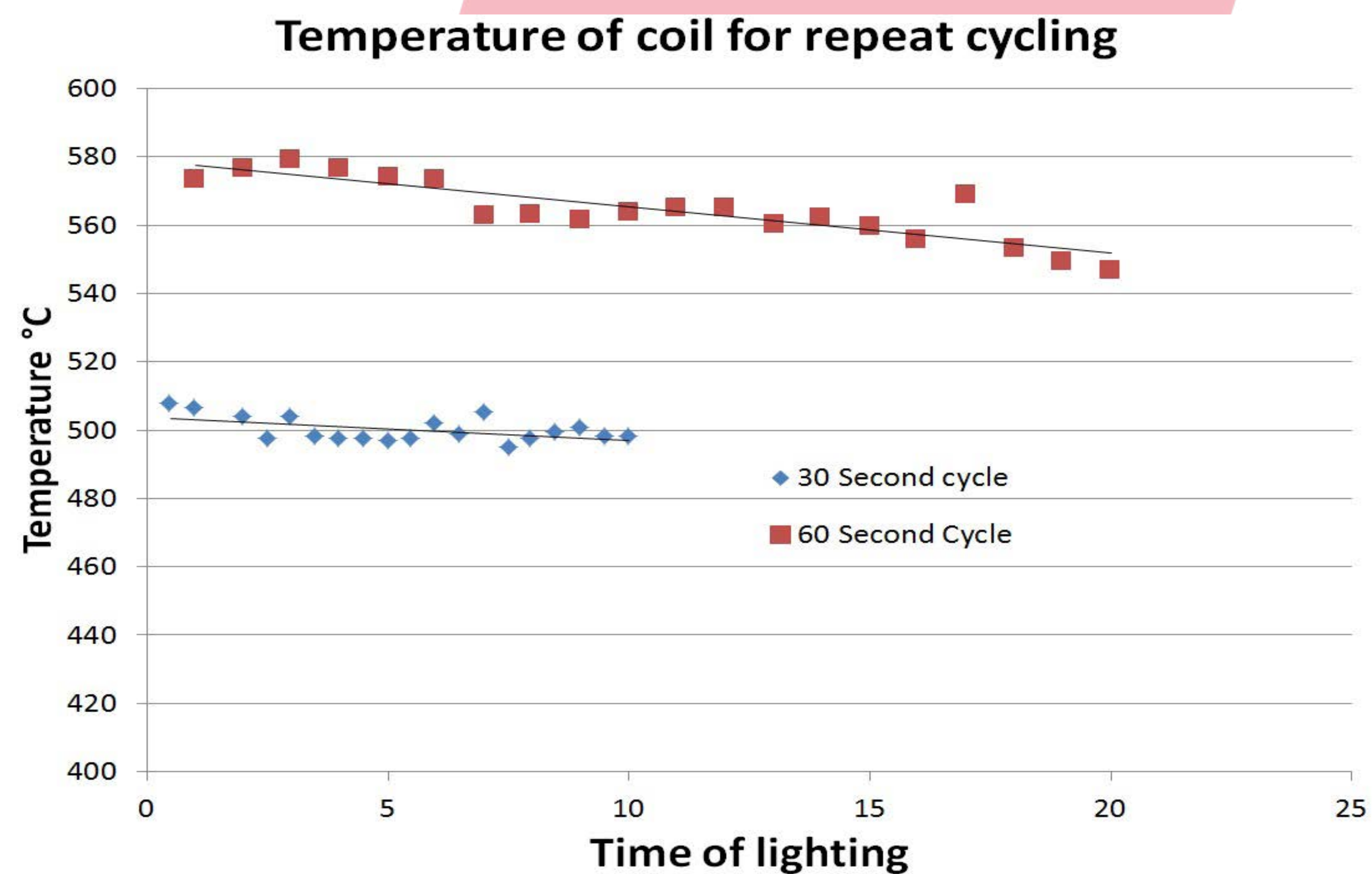


Figure 4: Decay in surface lighter temperature with repeat use cycle

### Discussion and Conclusions

Setting a nominal pre-light time is in practice setting the lighting temperature for the cigarette. The audible signal at the end of the pre-light time should signal the operator to raise the lighting bar before the lighting.

As can be seen from the data presented here the temperature of the lighters continue to increase after the pre-light time. Consequently it is important that the operator strives for consistency in lighting time after the audible lighting signal is received to avoid the potential for inconstant lighting temperature.

It is also evident that the temperature of lighting is dependant upon the pre-light time set, this should be consistent to remove a small source of CO variability.

Moreover the age of the lighter must be monitored and excessively lighters exchanged on a regular basis. Extending the lighter life may be achieved by increasing the pre-light time by 2 seconds every 100 cycles.