

USE OF CONDUCTIVE FABRICS AS TEMPERATURE SENSORS

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Aim

To assess the possibility of using conductive fabrics, "sensitive" to temperature, to produce wearable temperature sensors, by analysing the change of resistance of samples of fabric with conductive coatings of PANI and PEDOT.

To measure resistance variations in changing temperature conditions, an environmental chamber, able to regulate temperature and relative humidity was used.

Method

Resistance measurements were carried out on samples of cotton fabric coated with PEDOT and PANI by passing a current of 10 uA.

- Source Meter Keithley 2611 for the measurement of resistance.
- Thermocouple Delta Hd9016 temperature meter.
- Environmental chamber.



Figure 1 - Environmental chamber, temperature and resistance meter gauges used in the tests

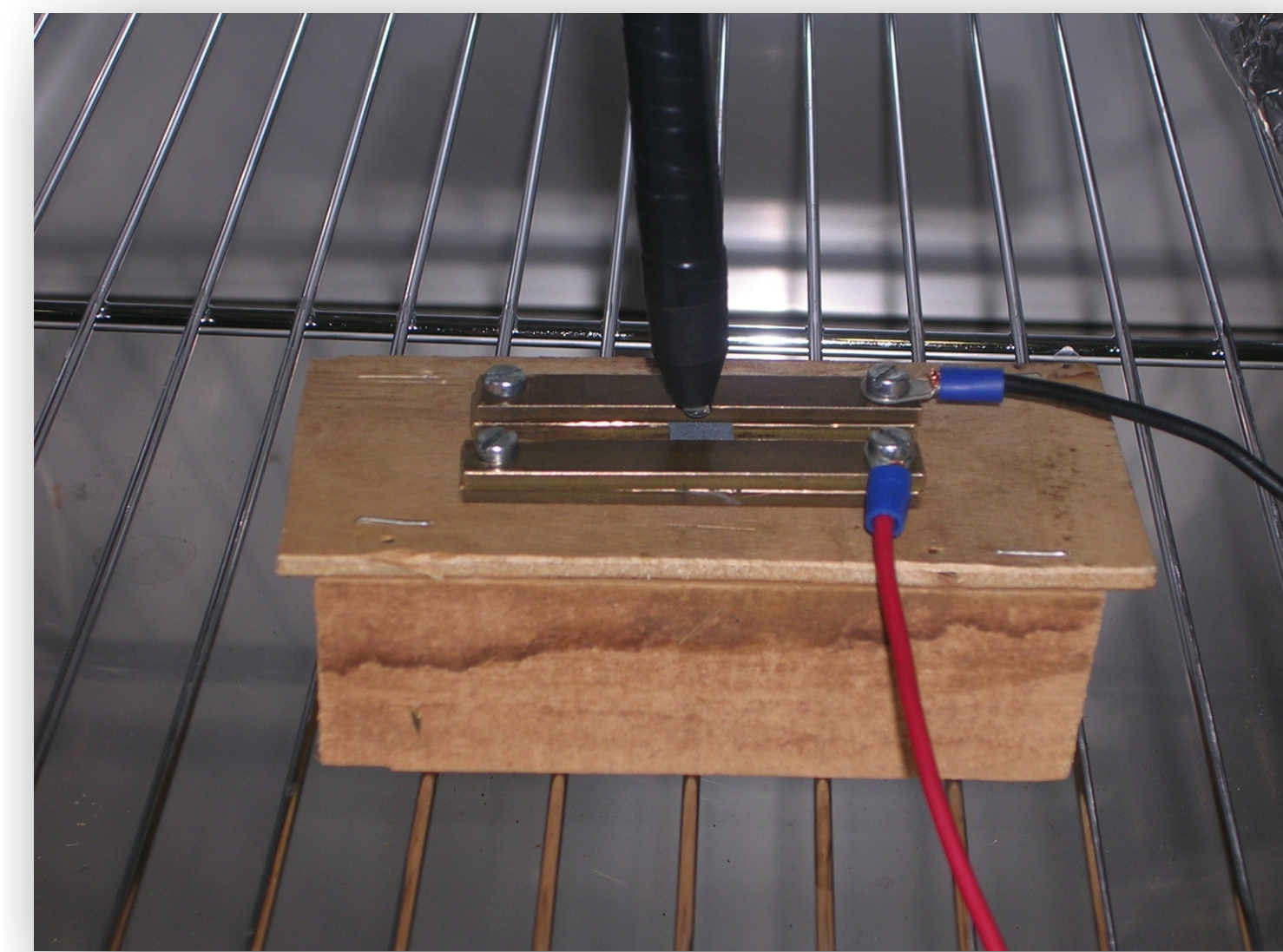


Figure 2 - Details of connection of fabric sample to the measurement system and probe of thermocouple thermometer

Results obtained:

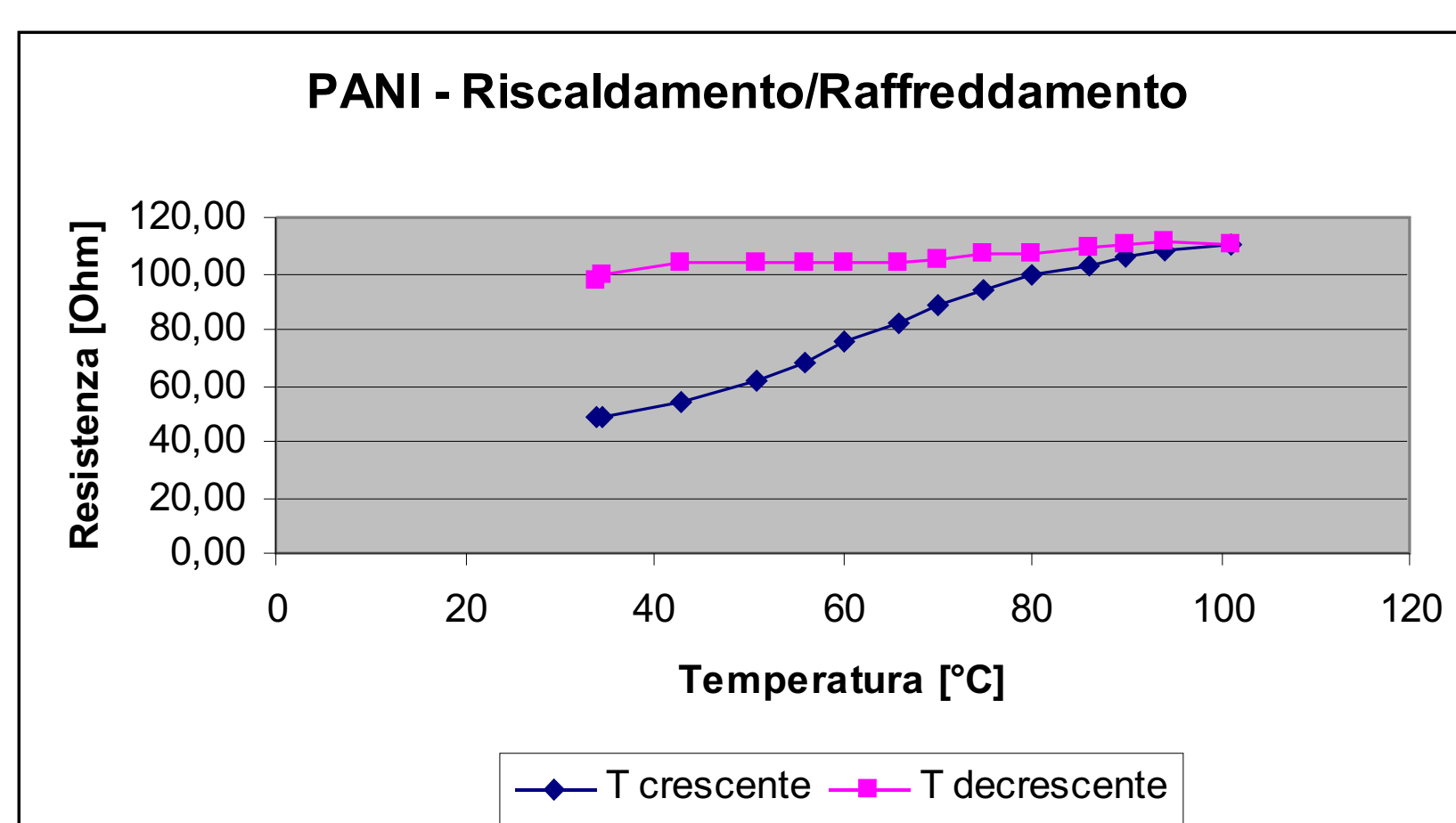


Figure 3 - The variation of resistance with temperature of the PANI sample during heating (blue) and during the cooling (fuchsia)

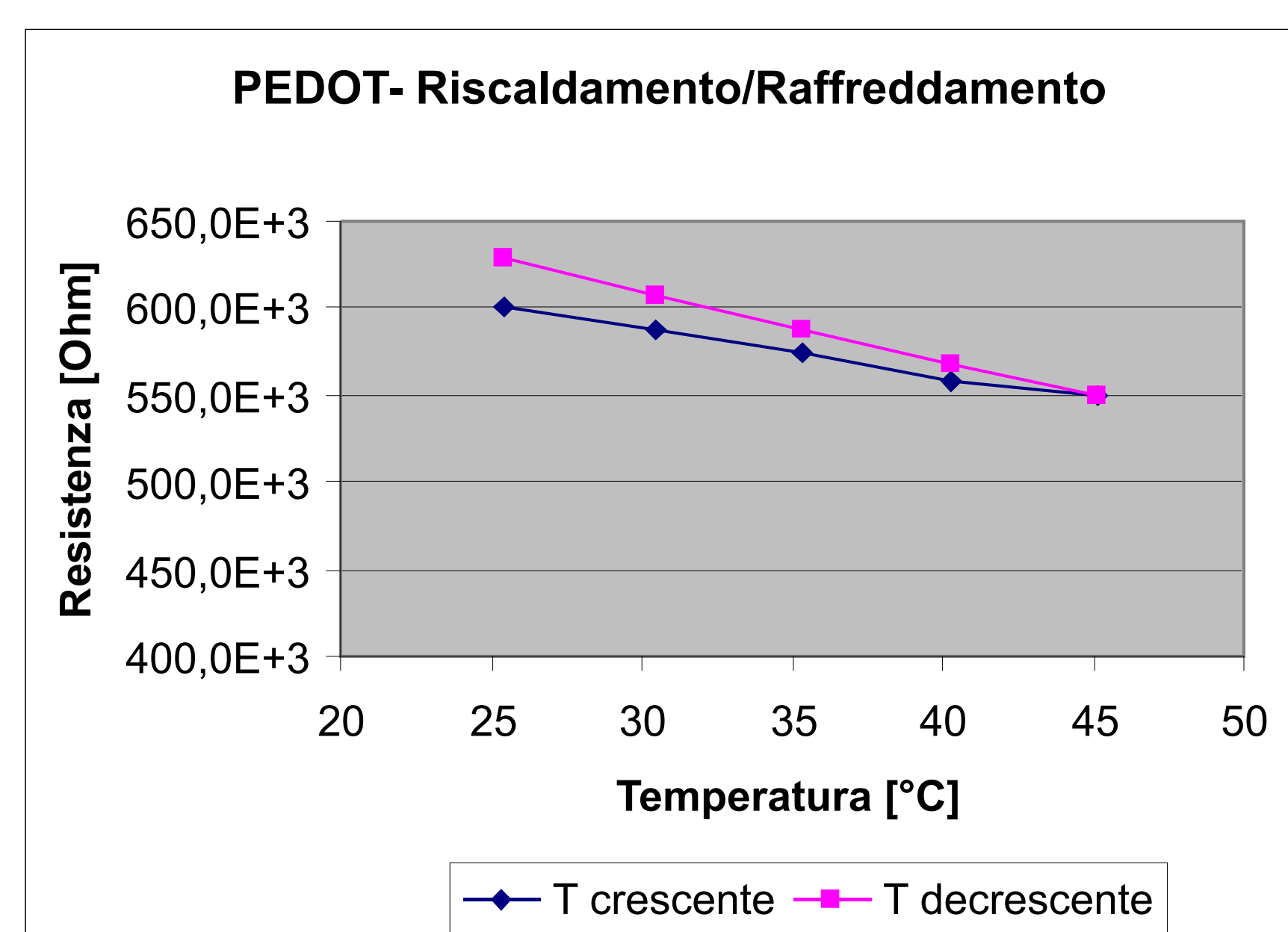


Figure 4 - The variation of resistance with temperature of the PEDOT sample in the heating phase (blue) and during cooling (fuchsia). Each measurement was made after 30' in the chamber to allow fabric to adapt to the conditions of temperature and humidity

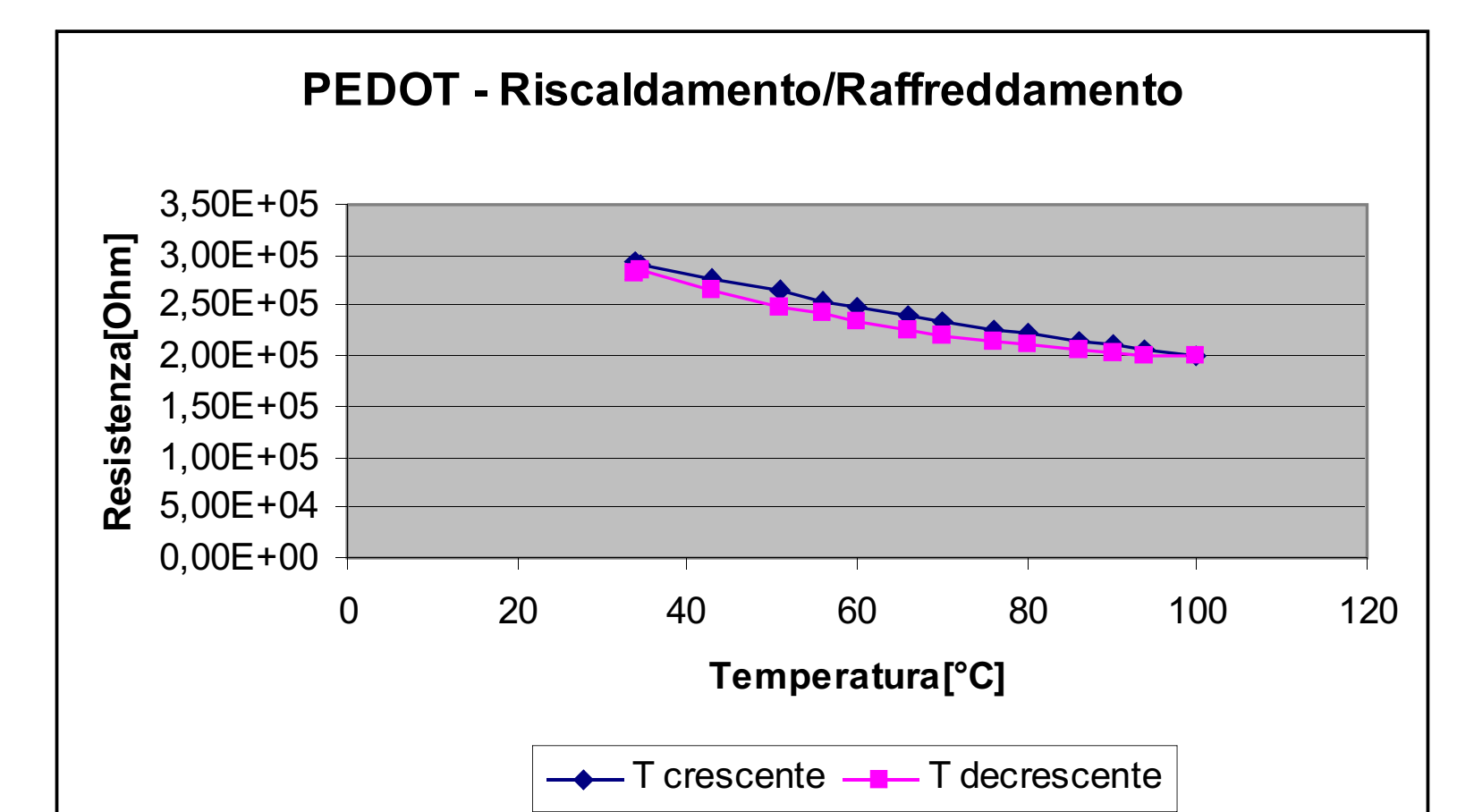


Figure 5 - The variation of resistance with temperature of the PEDOT sample during heating (blue) and in the subsequent cooling phase (fuchsia)

Conclusions:

By analyzing the results, a variation of the electrical resistance of the PEDOT fabric samples with the changes in temperature can be seen and is therefore promising for the development of wearable sensors.

There is however a hysteresis phenomenon, the warming up curve does not overlap with the cooling curve. Future developments of research will aim to identify the causes of this behaviour to try to solve the problem.

The graph obtained with the PANI fabrics shows a variation of resistance during cooling that does not correspond to the variation during heating, indicating that PANI is not a suitable material for the development of temperature sensors.