

Resistance evolution during the crack

Experimental determination of the relation between crack length and resistance in the aluminum film

After our first experiment on the traction machine, we realized that the theoretical static relation $R = \rho \frac{L}{w \cdot t}$ for the resistance¹ in the film isn't precise during propagation of the crack. We therefore did an experiment to determine the relation between resistance and crack length. The data from this experiment can then be used to calibrate the measurement on the traction machine.

We obtained the following values:

Crack length [mm]	R [Ohm] (mean)
1.5	3.17
5	3.21
10	3.37
15	3.6
20	3.94
25	4.34
30	4.98
35	5.83
40	7.17
45	9.37
46	10.4
48	12.55
49	16.43

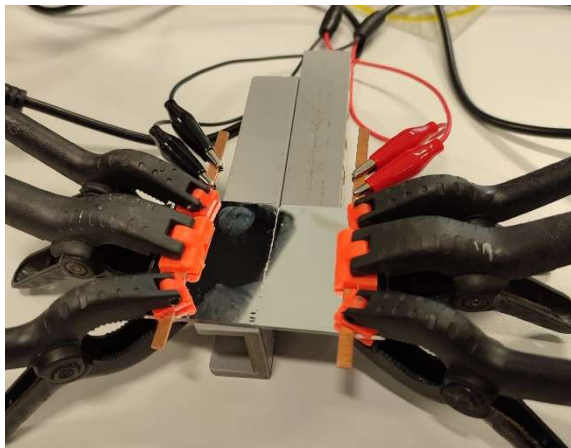


Figure 1: Setup of the experiment. We use a 4-wire measurement of the resistance of the aluminum film on the plate. The crack in the film is simulated by cutting gradually by hand. The four weights fix the copper strips that connect the film to the wires.

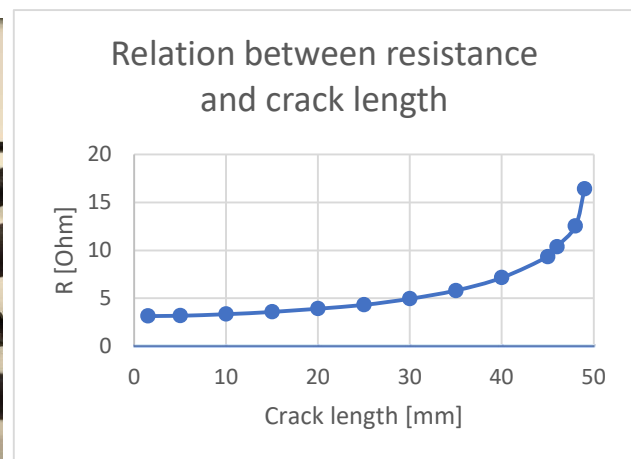


Figure 2: Graph of the measurement that show the relation between crack length and film resistance.

¹Wikipedia: Sheet resistance, (20.10.2021), https://en.wikipedia.org/wiki/Sheet_resistance, where $\rho = \text{resistivity}$, $A = \text{cross-sectional area}$, $L = \text{length}$