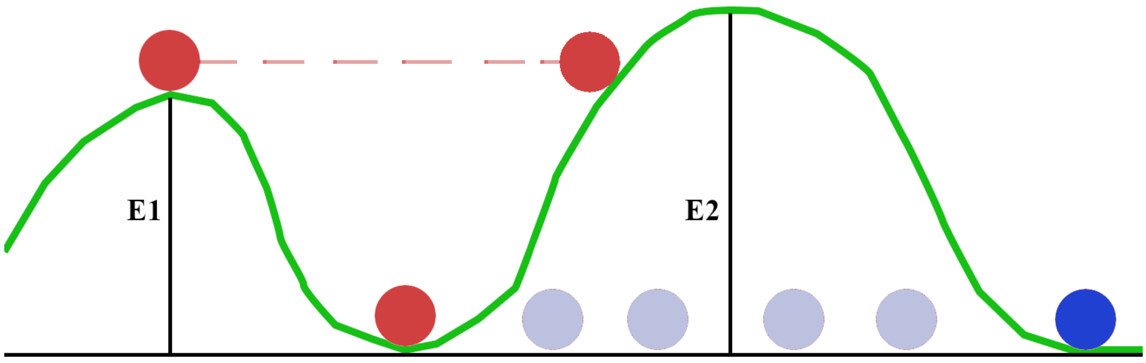

Fig. 1: A boulder on a hill, by classical mechanics in red, by quantum theory in blue. After being rolled, the red boulder will ideally reach at most the same height from which it was rolled. In the quantum world (blue boulder) there is a probability that the boulder will tunnel through the second hill.

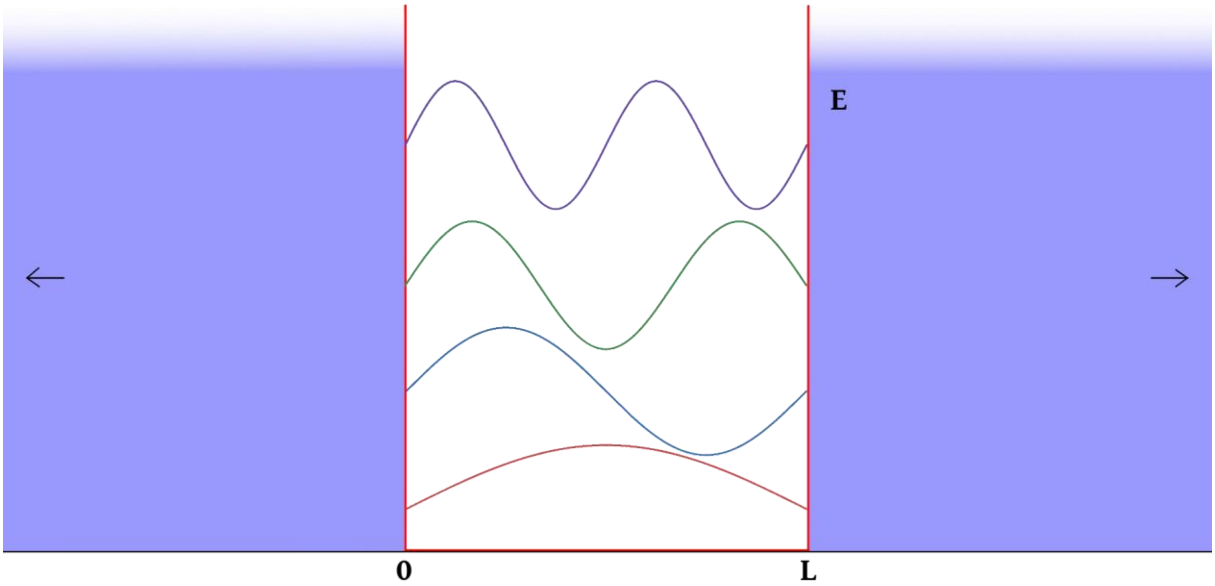

Fig. 2: Electron trap with regions of infinite potential marked in blue. In the middle is the white neutral region whose boundary is highlighted in red. An electron trapped in the neutral region is quantum and can therefore only be described by de Broglie waves of a certain wavelength. Some of these are shown in colour in the neutral region.

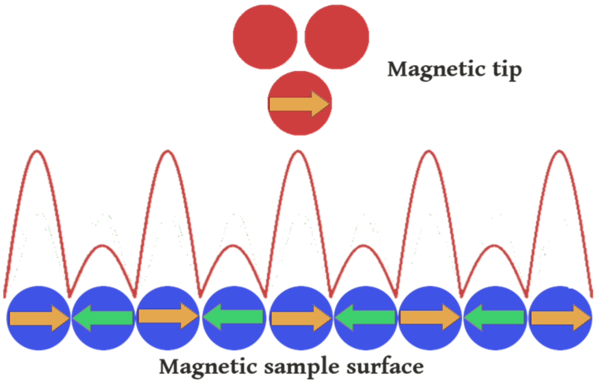

Fig. 3: Illustration of a spin polarized STM. When the tip has the same spin as the sample the current rises. Conversely, when the tip has the opposite spin to the sample, that is the combination of the orange and green arrows in the figure, the current will drop.

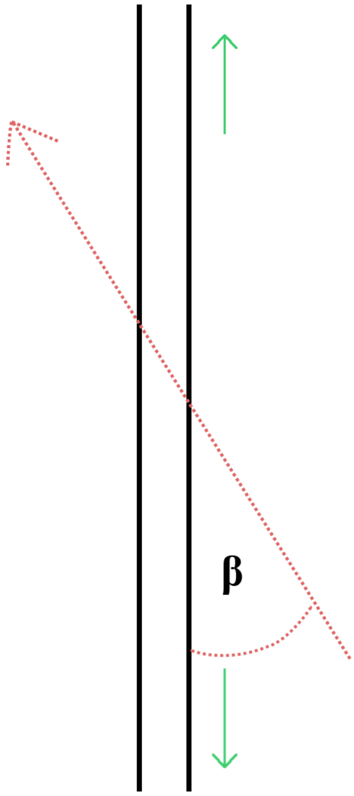

Fig. 4: Schematic of wire cutting. The red arrow shows the cutting direction and the green arrows the pull direction. **β** is the angle at which the wire is cut.

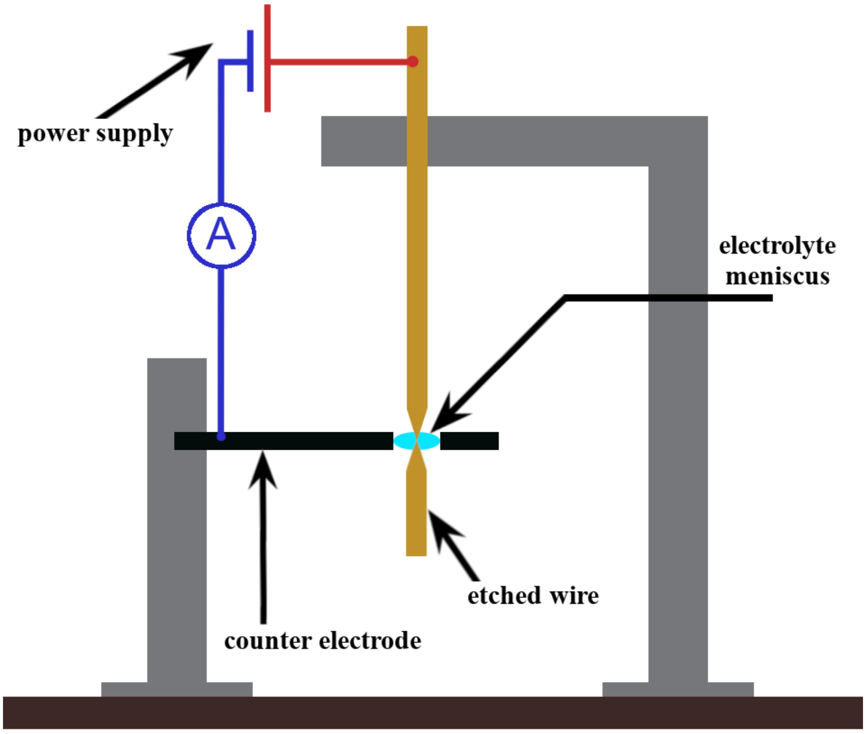

Fig. 5: Schematic of electrochemical etching of STM tips. The etched wire is held in a holder and inserted into the electrolyte membrane. The latter is held in a ring of counter electrode. When the voltage source is switched on, the wire is etched until the bottom part falls off to form a single tip. An ammeter is also wired into the circuit to monitor the current.

Fig. 6: An etching stand where the upper part was designed to hold a thin wire. The counter electrode was held in place by a threaded rod with two nuts. A petri dish was placed at the bottom to catch the tip.

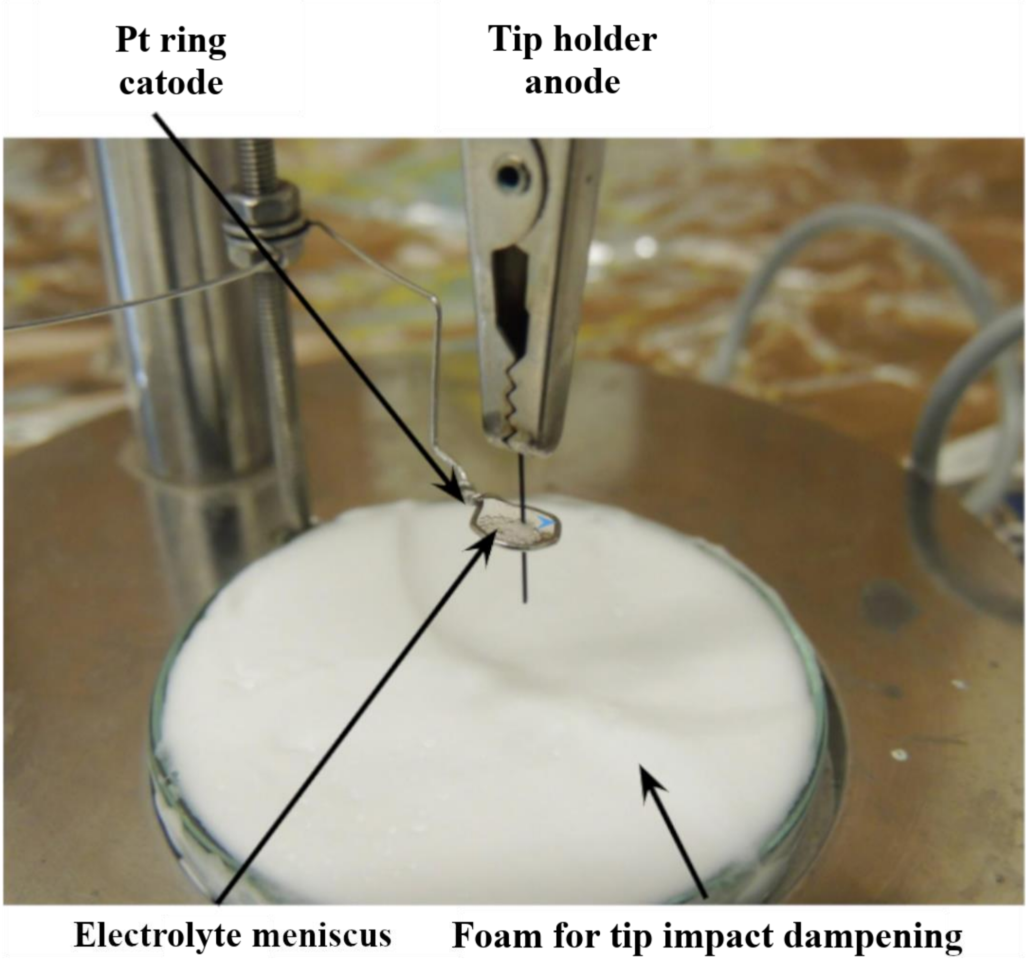

Fig. 7: Stand with microslide ready for tip etching. The etched wire is inserted into a 10% HCl membrane in a Pt ring. A maximum voltage of -10 V is applied to it. Under the wire is a petri dish with shaving foam to trap the tip.

Acid	Reactiviti	Formation of salts	Oxidation	Disociation	Note
sulfuric acid	++	+	++	+	strong oxidation of the tip
acetic acid	-	-	-	-	suitable for pre etch clening
formic acid	-	-	-	-	nonreactive
perchloric acid	++	?	?	++	dangerous, extreme reactivity
hydrochloric acid	+	+	-	+	optimal

FIG. 8: Graphical comparison of the properties of the individual acids with which I performed experiments. Only pure, water-diluted acids are shown here. The properties of their mixtures depend on the properties of the individual acids. The + sign shows a high level of a property, the ++ sign shows a very high level of a property,

the - sign shows a very low level of a property, and the ? indicates a lack of experimental data. Properties that are desirable are marked in green. Properties that are not desired are marked in orange.

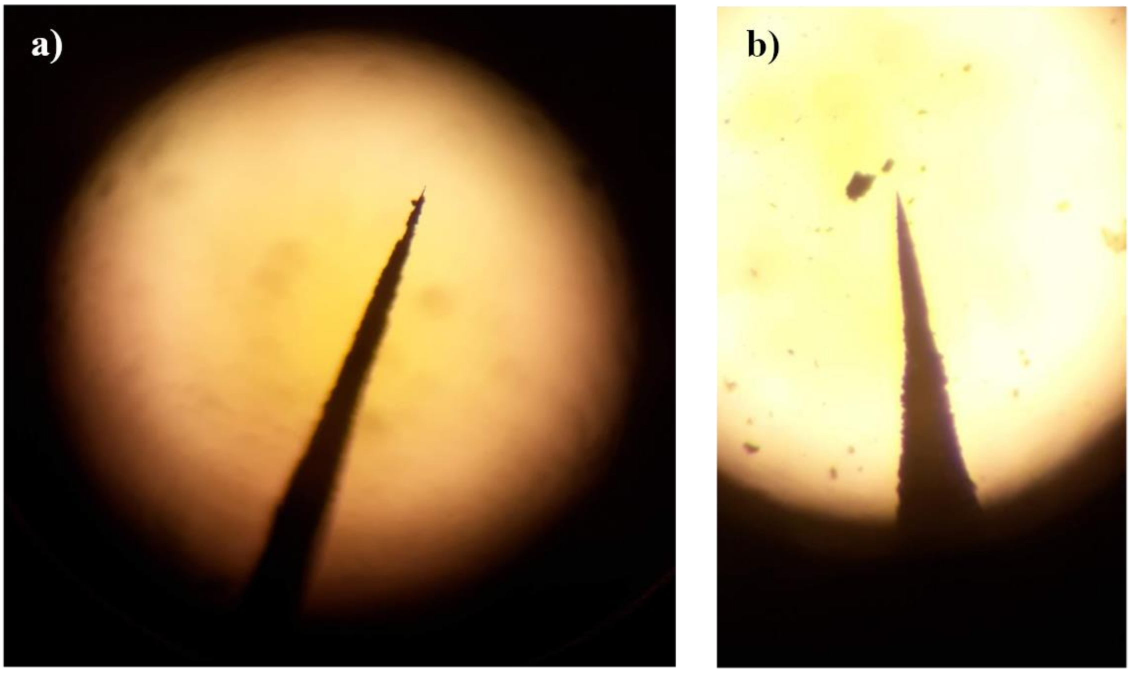

Fig. 9: Comparison of tips in binocular magnifier. In figure (a), you can see the formations near the tip. Figure b), on the other hand, shows scales on the broad side of the tip. Figure a) seems to be more suitable despite the possible instability of the formation near the tip.

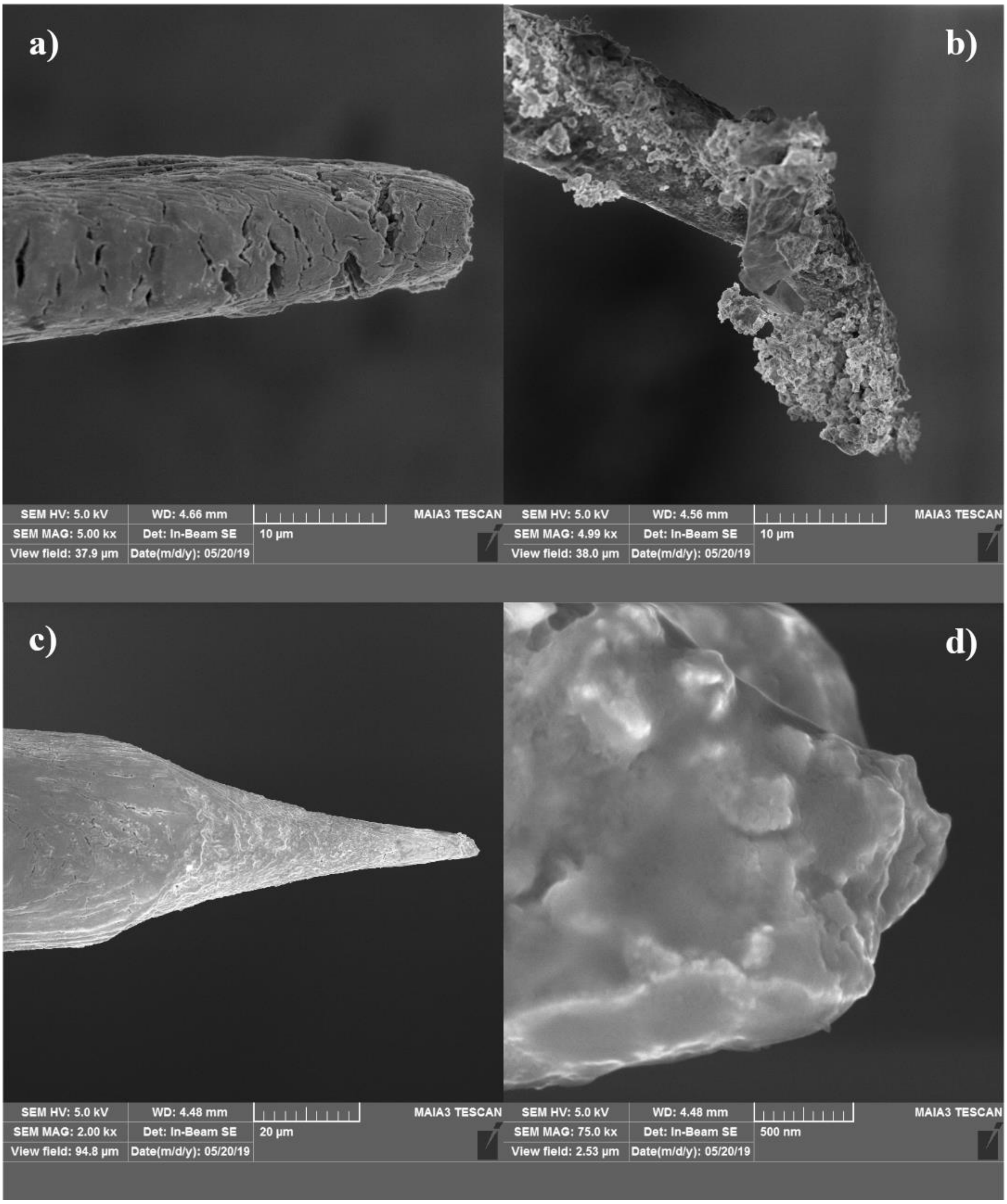

Fig. 10: Different types of tips observed by SEM microscope. In figure (a), microcracks can be seen that could cause material to fall off the tip in the microscope, but the shape of the tip is relatively good. In figure b) large scale formations on the tip are visible, and in addition the tip of the tip is broken, such a tip could never be used in a microscope. These scales were caused by too high tension and rapid etching. Figure c) shows a good quality tip without scales and in the correct shape. Figure d) shows a close-up view of the tip from c), which appears to be sufficiently sharp.

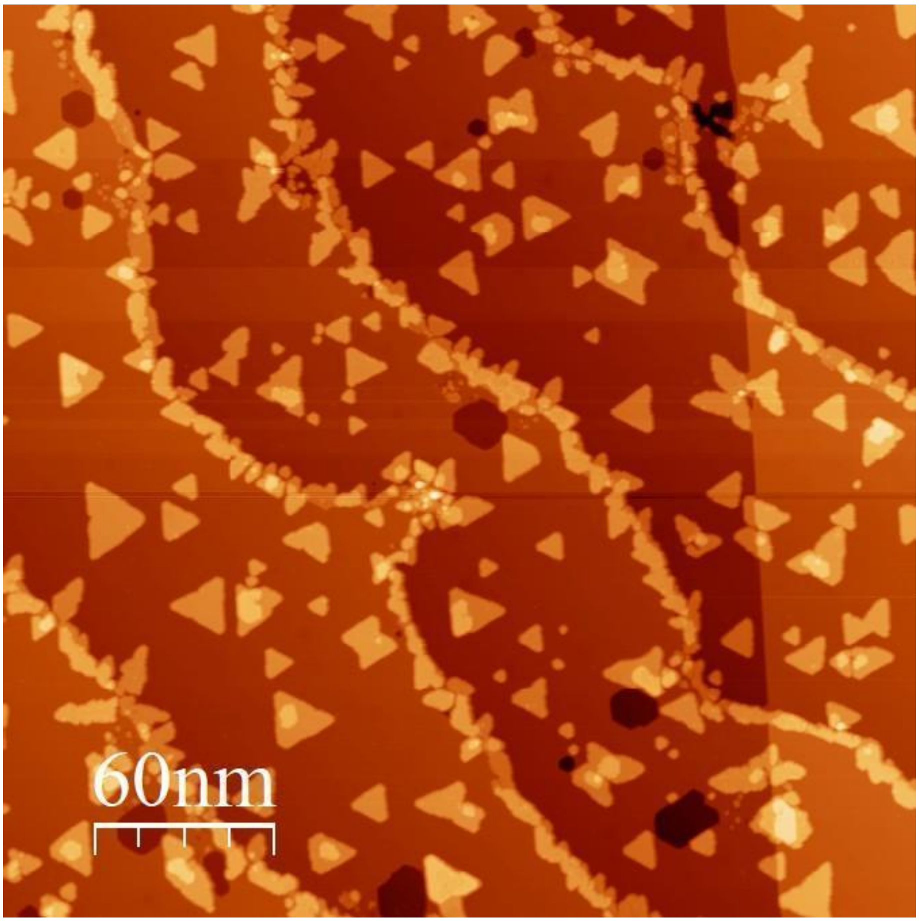

Fig. 11: Overview of the Cu(111) region with Co islands of double orientation of 300*300 nm. Large image taken to orient the subsequently measured region.

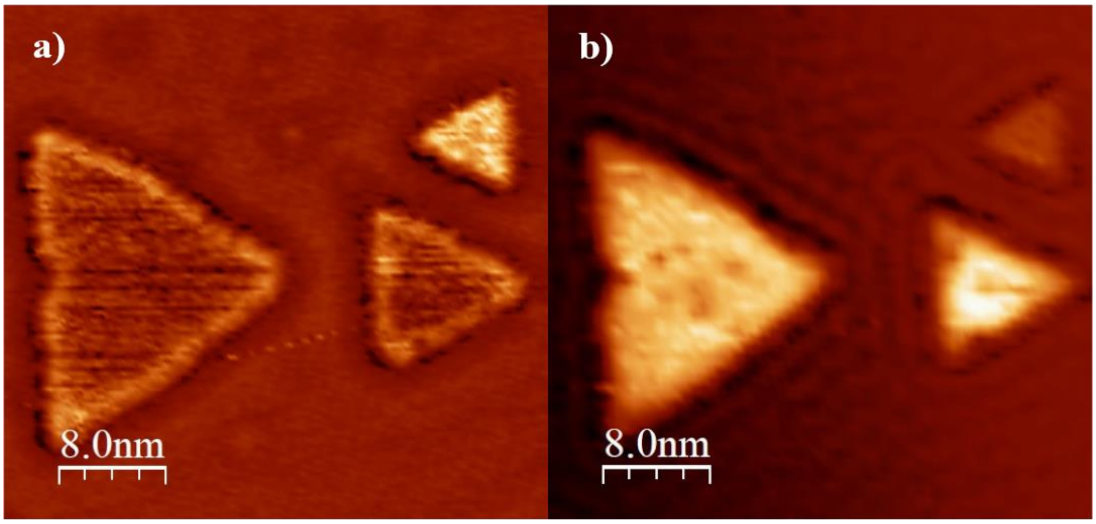

Figure 12: Figure showing the different LDOS for islands of different orientation. Figure a) was measured at -380 mV. Figure b) was measured at -270 mV.

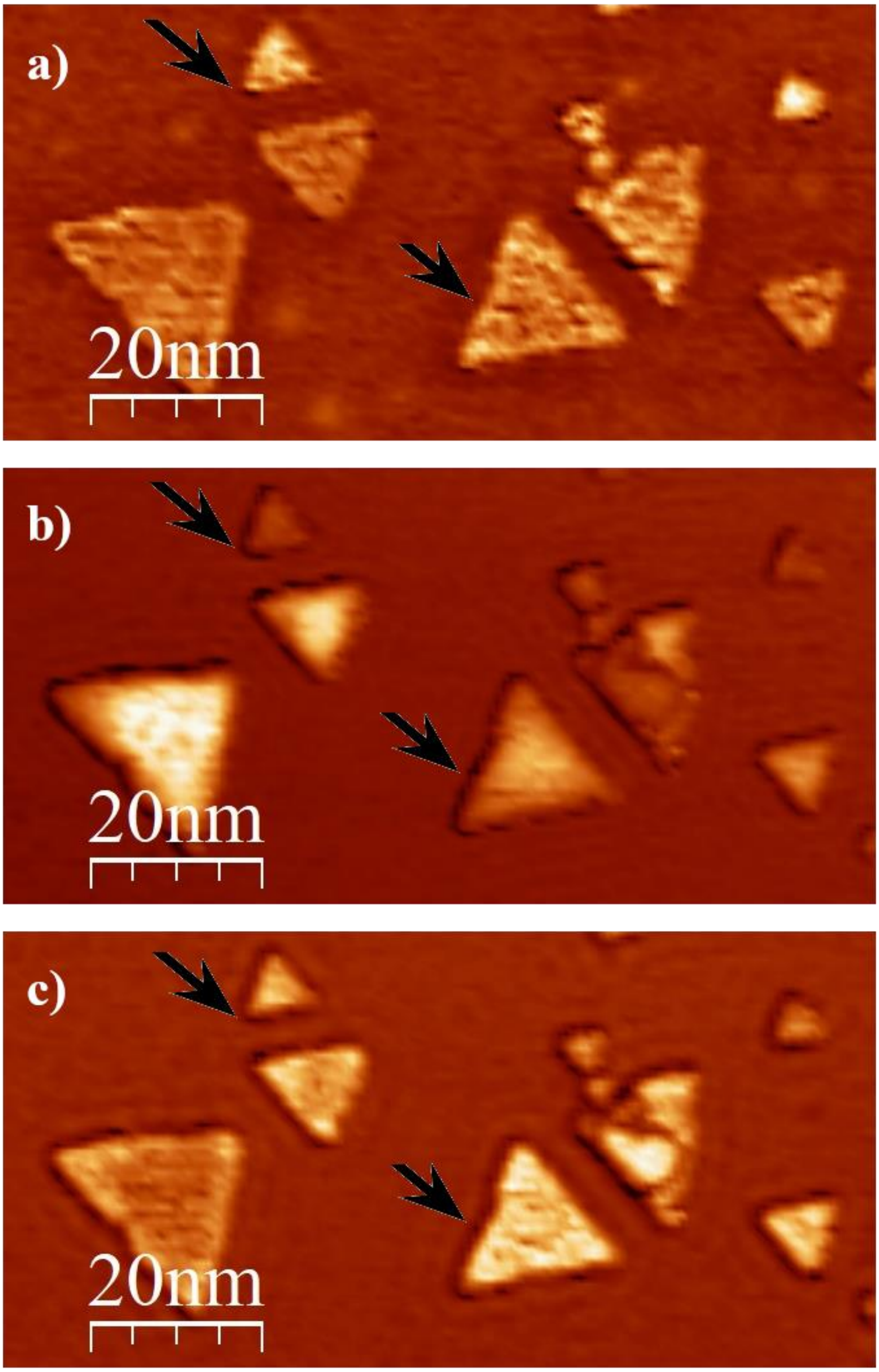

Fig. 13: The different intensity for islands of the same orientation and the same intensity for islands of opposite orientation together indicate the spin polarization of the MnNi tip used. Figure a) was measured at -447 mV. Figure b) was measured at -266 mV. Figure c) was measured at -340 mV.

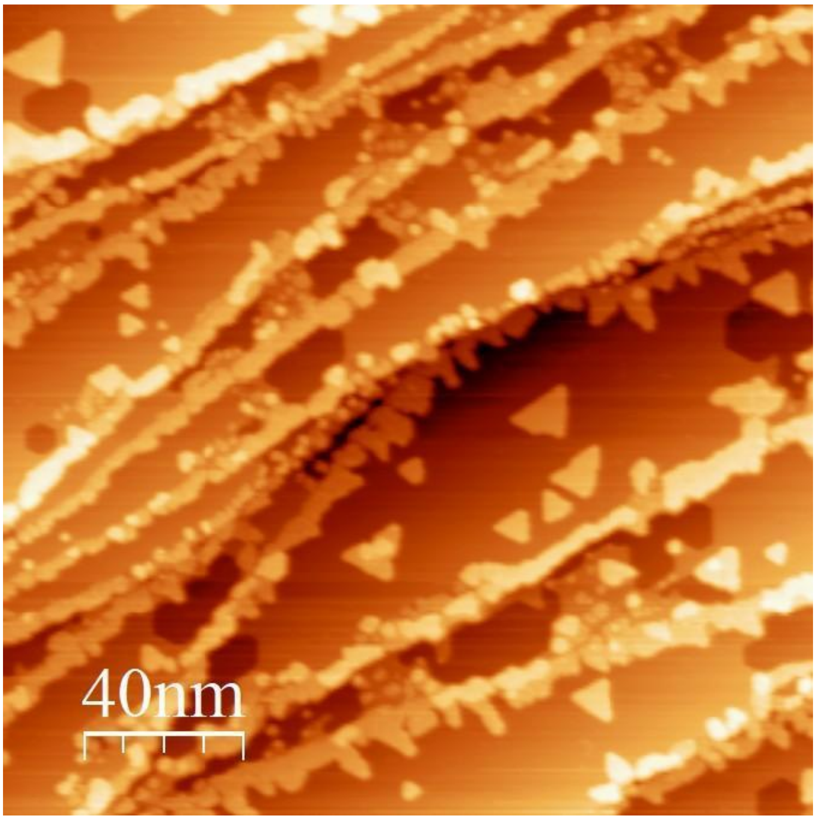

Fig. 14: Overview of the Cu(111) region with Co islands of double orientation of 200*200 nm. Large image of the new location taken to orient the measured area.

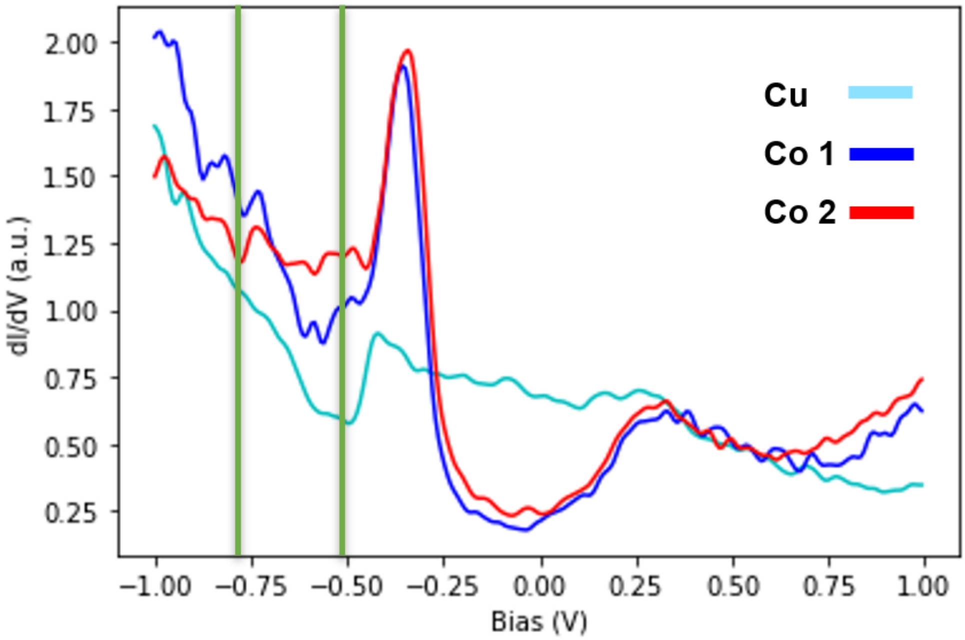

Fig. 15: Plot of LDOS Co islands on Cu(111) by numerically calculated derivative of tunneling current versus voltage. The turquoise curve is a control measurement on a Cu(111) single crystal.

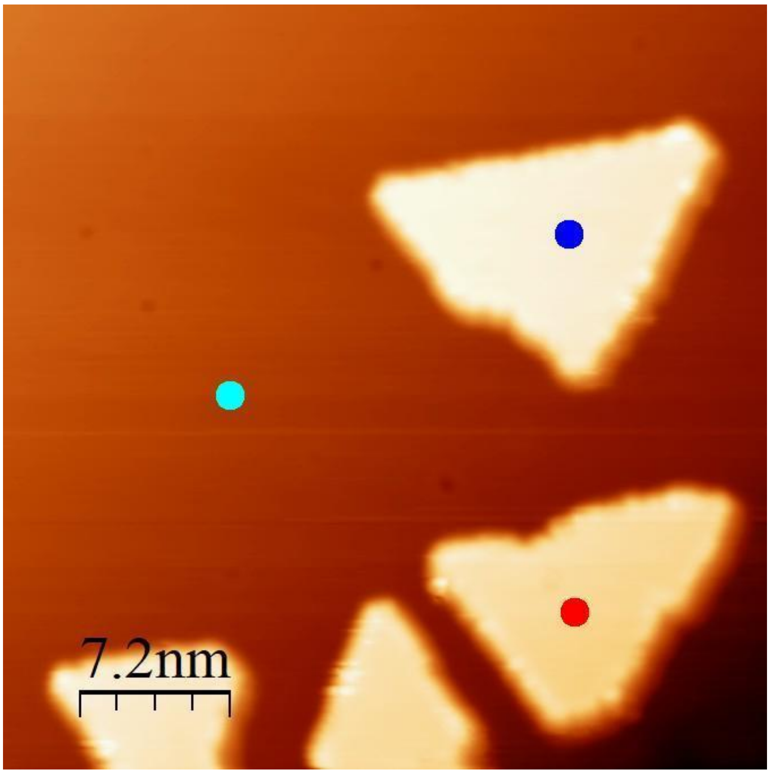

Fig. 16: Detailed view of the dIdV measurement site. The spectroscopy measurement points are marked in the figure and correspond in color to the LDOS curves in Figure 19.