Surface Characterization of Synthesized Rubies

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The atomic force microscope (AFM) is a measurement instrument which can be used to scan a mechanical surface. Measuring with the AFM has the advantage that the topological information and the roughness of the surface can reach values in the range of nanometers. The measuring process can also be used for many different materials and for small surfaces with a high technical requirement. Even the characterisation of the manufacturing process on a specific surface is possible.

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Starting point

Until today the industrial customer has measured their synthesized rubies as an research project at *École polytechnique fédérale de Lausanne*. Since the roughness of the surface ranging from 2 to 15 nm the measurement process must be done by using the atomic force microscope. The measurements are made on parts with a convex cylinder surface. The diameter of the synthesized rubies is 0.4mm and they have a length of 0.5mm. According to the evaluation of the measured surfaces at EPFL the roughness values are lower than Ra = 0.02 µm.

Goal

In the past the industrial customer has measured their parts at the École polytechnique fédérale de Lausanne. Now the main topic of the Bachelor Thesis to evaluate if there is the potential to transfer the measuring process from EPFL to BFH-TI in Biel. For this reason the action of the measuring process and also the evaluation process must be adjust for the new environment and compared with the measurement made at EPFL. For the future the goal is to arrange the qualitiy measurement for the industrial customer.

Course of action

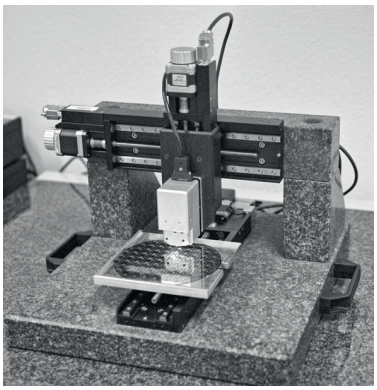
To achieve comparable measurement it is necessary to analyse specific topics of the project:

- parameters used for measuring at EPFL
- location and specific parameters of the measurement instrument
- evaluation with the specific software

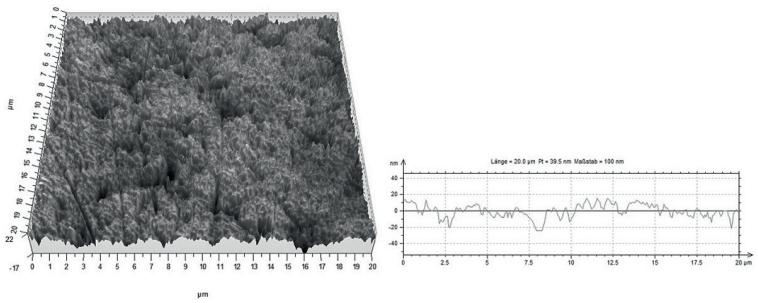
To reach comparable values at BFH-TI and EPFL it is important to analyse the location for measuring. This can be be made by a noise test. The noise test is a measurement where the scan head always measure at the same position. As a result there is only the move of the vibration visible. By setting up the tip-force, velocity and also PID-controler the measure can be optimized.

An enormous influence on the roughness values has also the evaluation of raw file and the software itself. With the help of the industrial customer the process of evaluation is proofed and it can be used for further measurement at BFH-TI. The adjustment has been made by comparing the same raw file with the two software and the specific application.

The advantage of a semi-automation process is that mulitiple parts can be positioned on the carrier and the visual basic code measures and evaluates the roughness of the parts automatically. Once the parts are positioned and aligned the program operates autonomously and there will be no further tasks for the tester.



The measurement instrument from BFH-TI



Measured surface with its roughness profil