Faculty of Electrical Engineering & Computer Science
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Correlation between Laser-Induced Indentations on Material Surface and Hardness Measurement.

ABSTRACT - Masterthesis

Hardness measurements are performed to evaluate the resistance of solid materials against shape changes when compressive forces are applied. To determine the hardness of a material in conventional measurement methods, such as Brinell hardness, two diameter of the indentions are measured and calculated with the applied force. A new hardness measurement method, based on laser induced shock waves is introduced. The high- energy beam of a nanosecond pulsed laser TEA-CO2-laser is absorbed by the target surface and suddenly results in an unstable plasma. Further interactions of the plasma with the laser beam generates a shock wave. The pressure of the shock wave is used to push a special shaped test specimen inside a material surface. This test specimen generates a deformed area. The laser induced indentions have shown high standard deviations and accordingly need to be analysed.

The essential point of the work is to understand the influence of the laser process on the resulting indention geometry in order to identify a measured variable for the laser-based hardness measuring method, which can describe the hardness of a tested material. Accordingly, laser–induced indentions are created with different shock wave pressures on different heat-treated specimens. It has to be proven if the laser-induced hardness indention measurement can be conducted similar to Brinell hardness measurement, or if further indention characteristics should be considered such as indention volume and depth.