PROZESS SIGNATUREN

TRANSREGIONALER SONDERFORSCHUNGSBEREICH 136

Universität Bremen · RWTH AACHEN UNIVERSITY · OKLAHOMA STATE UNIVERSITY

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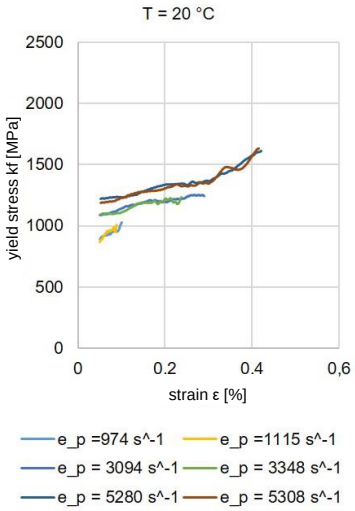
Materials Analysis and Heat Treatment

Subproject Z02 – Prof. Dr.-Ing. habil. Brigitte Clausen

Objective and approach

The scientific service project Z02 supports the other subprojects, in particular those in the M and F areas, with results from metallographic analyses and the determination of characteristic values from investigations on a thermal and mechanical simulator. Furthermore, Z02 is responsible for the material logistics and heat treatment of the steel used in the collaborative research center. In additionally, in accordance with the results of subproject M02/Mechanism Analysis from the first phase, it offers defined loading of machined surface layers for the experimental simulation of multiple stresses and for the investigation of the stability of surface layer modifications.

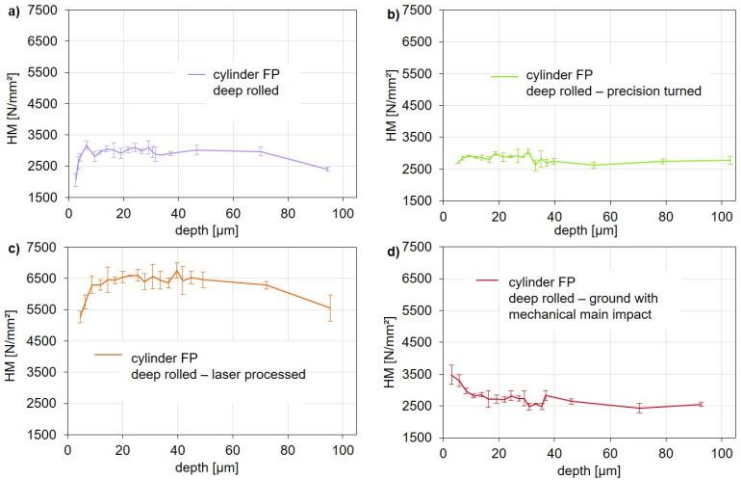
State of knowledge (April 2021)



Knowledge of the material properties is essential for simulation. In cooperation with BGTB GmbH Dortmund, tests were carried out at high strain rates at various temperatures to determine the characteristic values and extend the material model.

For the second round robin test in the working group mechanisms, the effect of experimental process chains on Martenshardness was investigated, among other things.

Depth profiles of the Martenshardness of deep rolled cylinders in the ferritic-pearlitic condition and subsequently machined further



a) ferritic-pearlitc (FP) condition deep rolled (F01/strengthening)
b) cylinder as in a) additionally precision turned (F05/precision turning
c) cylinder as in a) additionally laser processed (F07/laser processing)
d) cylinder as in a) additionally ground with mechanical main impact (F01/strengthening)

Conclusions and further approach

For a better understanding of the manufacturing processes, it is necessary to understand the material behavior during rapid deformation. In cooperation with BGTB GmbH Dortmund, characteristic values were determined at high strain rates.

For the development of process signatures of process sequences, a second round robin test was planned and carried out by Z02 in the working group mechanisms.

At the end of the second funding phase, the subproject Z02 is concluded and its tasks will be transferred to other subprojects in the SFB/TRR 136.

Publications

[1] Strunk, R.; Borchers, F.; Clausen, B.; Heinzel, C.: Influence of sequentially processed mechan-ical and thermal loads on surfaces ground with mechanical main impact; MDPI Materials 2021, 14, 2386, 10.3390/ma14092386.

[2] Ehle, L.C.; Strunk, R.; Borchers, F.; Schwedt, A.; Clausen, B.; Mayer, J.: Influence of process chains with thermal, mechanical and thermo-mechanical impact on the surface modifications of a grind-strengthened 42CrMo4 steel, Procedia CIRP 87 (2020), 426–431, 10.1016/j.procir.2020.02.088.

[3] Borchers, F.; Clausen, B.; Eckert,S.; Ehle, L.; Epp, J.; Harst, S.; Hettig, M.; Klink, A.; Kohls, E.; Meyer, H.; Meurer, M.; Rommes, B.; Schneider, S.; Strunk, R.: Comparison of Different Manufacturing Processes of AISI 4140 Steel with Regard to Surface Modification and Its Influencing Depth, Metals, 10 (2020), 10.3390/met10070895.