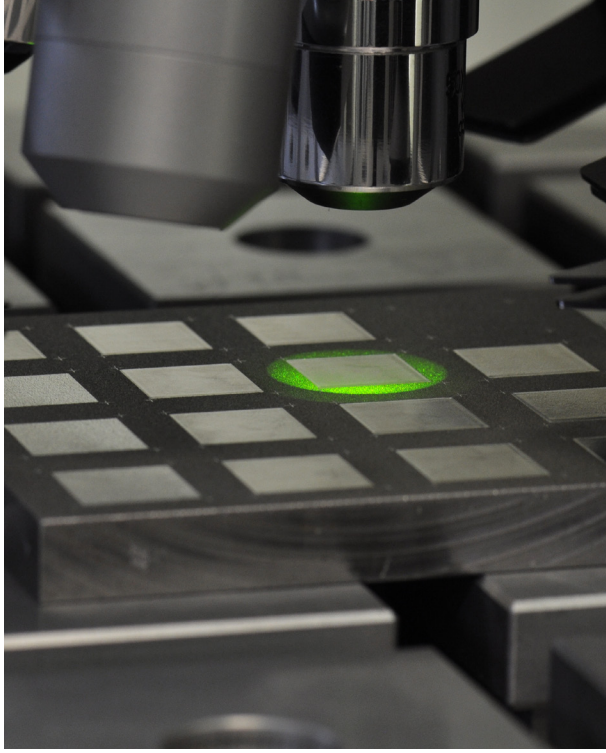

1 Industrial 3D laser polishing system.
2 In-situ white light interferometry measurement.

AI-based, automated determination of the process parameters for laser polishing

As with many laser processes, determining suitable process parameters for laser polishing of metals requires expert knowledge and a great deal of manpower. When materials are exchanged and there are major changes in the initial roughness, the process parameters must be adapted experimentally or redetermined. The surface structures created during laser polishing, such as undercuts, bulges or martensite needles, limit the minimum achievable roughness. However, the surface structures can be significantly reduced by specifically adjusting the process parameters. To do this, the test surfaces are first polished with the laser. Then, process experts carry out topography measurements using white light interferometry and analyze these for surface structures, a process step that involves considerable effort.

Self-learning, automated laser polishing system

To automate the development of process parameters, Fraunhofer ILT has integrated a white light interferometer into a laser polishing system, in collaboration with Karl H. Arnold Maschinenfabrik GmbH & Co. Newly developed control software (work flow controller) coordinates the laser polishing system, laser and optics as well as the white light interferometer, thus enabling an automated process consisting of experiment planning, laser polishing and subsequent in-situ measurement. Measured topography images are checked for roughness features and as are surface structures using AI-supported analysis software. With the help of a module specially developed for laser polishing metals, process parameters are evaluated and provided to the user in pre-filtered form.

Classification of surface structures with AI

The automated laser polishing system already saves up to 50 percent working time compared to conventional process parameter development. For the first time, an AI module for classifying surface structures was trained on a data set of over 2500 topography images. Previous results show an accuracy of over 95 percent for individual structure recognition and up to 82 percent for structure overlays.

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