Cleaning and Surface Treatment with Pulsed High Power Fiber Lasers

Michael Grupp
IPG Laser GmbH
Burbach Germany

***Abstract*—Surface treatment with high power pulsed fiber lasers gets more and more interesting to wide range of applications due to higher available average power and pulse energy. The average power is either increased by higher repetition rates or higher pulse energy. New laser concepts allow the parallel combining of several fiber laser modules up to an average power of several kilowatts. These lasers increase the efficiency of the processes by high removal rates. This paper gives an overview on the various applications of surface treatment such as cleaning of molds, depainting and surface preparation for welding and gluing.**

Keywords—Laser cleaning, pulsed fiber lasers, de-coating, surface modification

I. Introduction

Many industrial applications such as welding or glueing require a treatment of surfaces prior to the process. Reasons can be the activation of surfaces, removal of contamination (oil, grease), removal of oxide layers or the removal of paint or protective coatings. This is done by the use of high dynamic scanning systems and short pulsed lasers with high pulse energy. Depending on the layer or contamination thickness single of multipass technology is applied. Increased process speed can either be obtained by high pulse repetition rate or high pulse energy on a relatively big spot size. By the use of square or rectangular fibers high removal rates with homogeneous ablation can be realized, Fig.1.

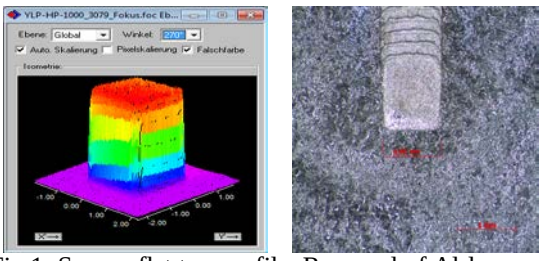

Fig.1: Square flat top profile. Removal of Al-layer on steel

II. Applications

A. Removal of protective coatings

Todays automotive industry is using a high amount of high strength hot formed steel in order to reduce vehicle weight by reducing sheet thickness. Due to the hot forming process the coating of the steel can no longer be done by zinc, but by aluminum-silicon. While welding these high strength steels the Al layer cause inter-metallic phases with the Fe which can cause cracks in the welds. Prior to the welding process this 30-40µm thick layers can be removed by an ablation process. With a spot size of 1 mm (square) the layer can be removed at the same speed as the welding process, so that a one-step process can be applied.

B. De-painting

Large area or selective (partial) de-painting with pulsed lasers is today already state-of-the-art for various applications in aviation industry, construction or shipbuilding and repair. The relatively thick coatings and the large areas require high removal rates of several 10 sqm/h. The main advantage of laser de-painting is the absence of medias such as toxic chemicals (solvents and acids) and abrasives.

C. Cleaning of molds

Cleaning of molds with abrasives can lead to wear and reduced surface quality of the produced parts. By laser cleaning the mold surface does not get damaged and thus increases the lifetime of the mold.

III. Summary

This paper gives an overview on current cleaning processes and an outlook on potential applications by the use of a new generation of high power fiber lasers.