KOSZALIN UNIVERSITY OF TECHNOLOGY
MECHANICAL FACULTY
PRODUCTION ENGINEERING DEPARTMENT

ANALYSIS OF THE POSSIBILITIES OF LASER SUPPORT OF THE FRICTION DRILLING PROCESS

Kacper SZWAŁEK[*], Krzysztof NADOLNY[2]

[1*]Faculty of Mechanical Engineering, Department of Production Engineering, Koszalin University of Technology, Raclawicka 15-17, 75-620, Koszalin, Poland, e-mail: kacper0191@interia.pl
[2]Faculty of Mechanical Engineering, Department of Production Engineering, Koszalin University of Technology, Poland

1. INTRODUCTION

Thermal drilling (thermoforming, thermal drilling) - an innovative technique for making threaded connections and perforations of metal materials with a thickness from approx. 1 mm to 12 mm, as an alternative to, inter alia, nitro-nuts, welded nuts, sealed nuts, pressed and screwed nuts and other joining techniques. During machining, a medium length sleeve corresponding to 3 to 4 times the thickness of the material is produced.

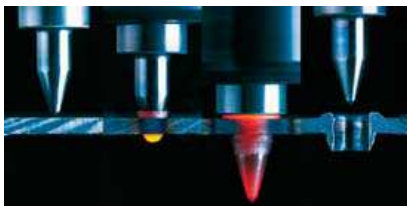

Fig. 1. Thermal drilling process scheme.

2. THE USAGE OF LASERS IN MACHINING

The first lasers were started to be built in the 1960s. Over the years, they have been applied in many areas of human life. Medicine, electronics, entertainment. A very wide field of application for lasers has been created by industry. The main application of lasers in machining is sheet metal processing.

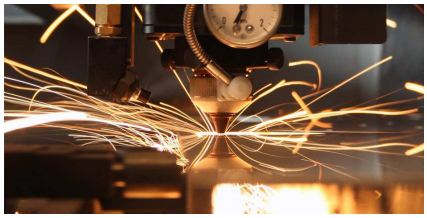

Fig. 2. Sheet metal laser cutting.

Laser applications in machining can also be listed:

- welding;
- laser assisted turning;
- micromachining;
- drilling;
- soldering;
- surface marking;
- surface cleaning.

3. CONCEPT FOR THE CONSTRUCTION OF A TEST STAND

The main source of inspiration for the initiation of work on this type of technology was the laser assistance turning process. The assumptions for the process are as follows:

- preheating of the working area with laser light of approx. 100 W power;
- making a hole by friction drilling;
- cooling of the processing area.

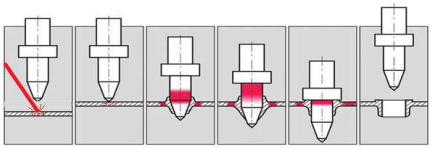

Fig. 3. Laser assisted thermal drilling process scheme.

The concept assumes the construction of a test stand on a lightweight vertical tool milling machine equipped with a set of tools for friction drilling.

Fig. 4. Milling machine with mounted thermal drilling set.

The laser light directed towards the point of contact of the workpiece with the drill bit will be produced from a source with an output of approximately 100 W. Due to the easy transmission of the beam, a fiber optic laser will be used.

Fig. 5. Laser light source with fiber cable.

In order to accurately record the temperature parameters of the process, it is anticipated that a thermal imaging camera will be used.

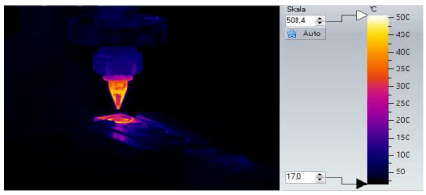

Fig. 6. Thermal drilling process thermogram.

4. EXPECTED RESULTS

The main expected result of the designed process is to conduct research on the influence of the laser light used in the friction drilling process. Further objectives can be identified:

- determination of the parameters of the concentrated laser beam potentially used in the process.
- determination of the influence of the concentrated laser beam on the duration of the friction drilling process.
- determination of the influence of the concentrated laser beam on the quality parameters of the holes made using the friction drilling method.