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# LASER ABLATION INVESTIGATION OF TUNGSTEN CARBIDE FOR TOOL MANUFACTURING PURPOSES

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**Introduction:** Drilling and cutting tool manufacturing has been a cornerstone of industry for centuries, enabling precision and efficiency in various areas such as instrumentation, automotive, aerospace, medical and more. Traditional methods, characterized by reliance on mechanical processes like grinding have long dominated the production of these essential tools. However, with the rapid development of technology, especially with the reduction of element sizes, there is a need for adjusted production solutions. Micro milling meets high precision requirements, but with a decrease in the diameter of the tool, cutting forces lead to a large percentage of defects. Furthermore, the flexibility in tool design is limited to the attributes of the grinding wheel. These restrictions in micro-tool manufacturing can be avoided by using pulse laser ablation method [1]. The utilization of lasers offers numerous advantages, including higher precision, reduced material waste, and improved tool longevity [2].

**The main part:** Samples of Tungsten Carbide (WC) have been prepared for the experimentation, following which an Ytterbium fiber laser with nanosecond pulse durations has been set up and configured, and the following tasks were performed:

1) Performing laser ablation to create square-shaped structures on the WC samples using the Ytterbium fiber laser while modifying the pulse duration, pulse repetition rate, and scanning speed for different sets of samples.
2) Measuring depth of the structures created on each sample using appropriate measurement techniques and calculating the ablation efficiency for each set of structures by considering the depth achieved and the energy input. Then recording the depth measurements and ablation efficiency values obtained for each parameter combination.
3) Comparing results by analyzing the data to identify correlations between the parameters used in the experiment and the depth of structures as well as the ablation efficiency to determine the optimal combination of parameters that yield the desired depth of structures while maximizing ablation efficiency.

**Conclusion:** The work involved preparing WC samples with a Ytterbium fiber laser, varying parameters during laser ablation, measuring structure depth and ablation efficiency, and analyzing results to optimize parameters for effective laser processing on WC.

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