

WORKSHOP ON SURFACE ENGINEERING



COOLING PROCESS REQUIREMENTS FOR PRECISION PROCESSING PROCESSES

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Summary

The article presents the cooling method used in the cutting and grinding processes. Compressed air cooling is also used to cool the injection molds. It is used in the machinery industry and can be successfully used on production lines equipped with compressed air systems. Increasingly, there are more and more often found cooling systems using vortex tubes in the automotive and aerospace industries.

Introduction

Realization of technological processes of production is connected with the generation of large amounts of heat in the treatment zone. Proper choice of cooling fluid must take into account the chemical affinity of workpieces as well as the construction and chemical composition of shear or abrasive tool coatings. The cooling process should be of high efficiency in view of the need to maintain adequate thermal conditions in the treatment zone. Overheating of the machining zone can lead to increased tensile stresses in the surface layer of the workpiece and contribute to degradation of the surface and the surface layer of the workpiece. In the implementation of cooling and lubrication in the cutting and grinding processes, the nozzles that serve to drive and feed the lubricant (SSP) are essential. Examples of such nozzles are cooling nozzles, whose operation is based on the principle of a vortex tube, to which two air streams in opposite directions (Figure 1).

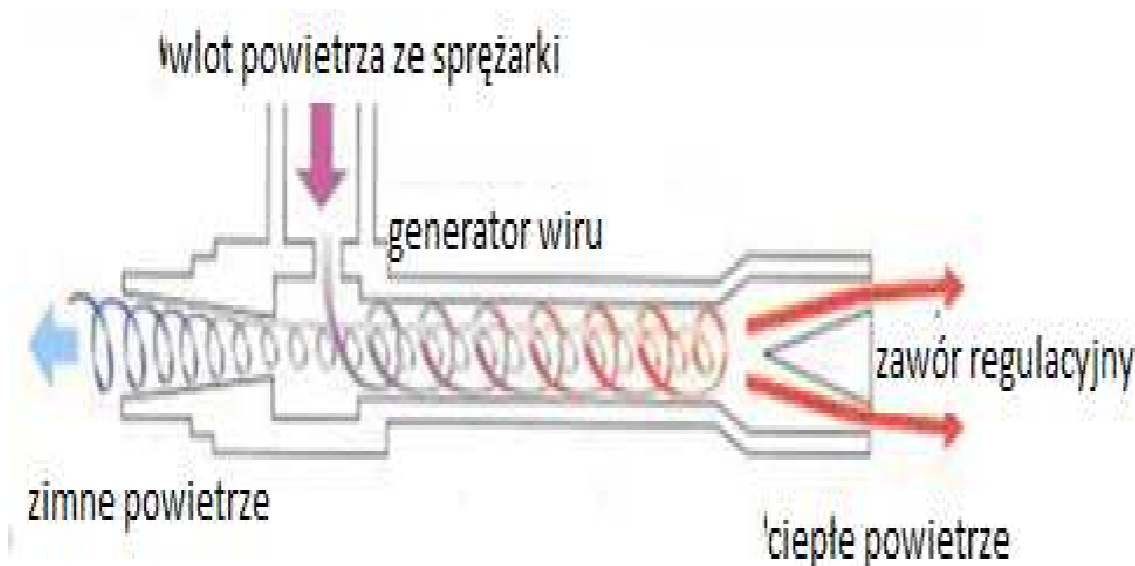


Fig. 1. Construction of a vortex tube



Fig. 2. Research facility using industrial robot



Fig. 3. Research station using Digima CNC numerically controlled machine tool. 1-cooling nozzle, 2-working CNC milling machine, 3-way compressed air supply [3]

The research was carried out on aluminum, ceramic and steel samples in the form of cuboid. Samples were subjected to grinding and milling. Machining processes were performed on selected sample surfaces (fig.4).

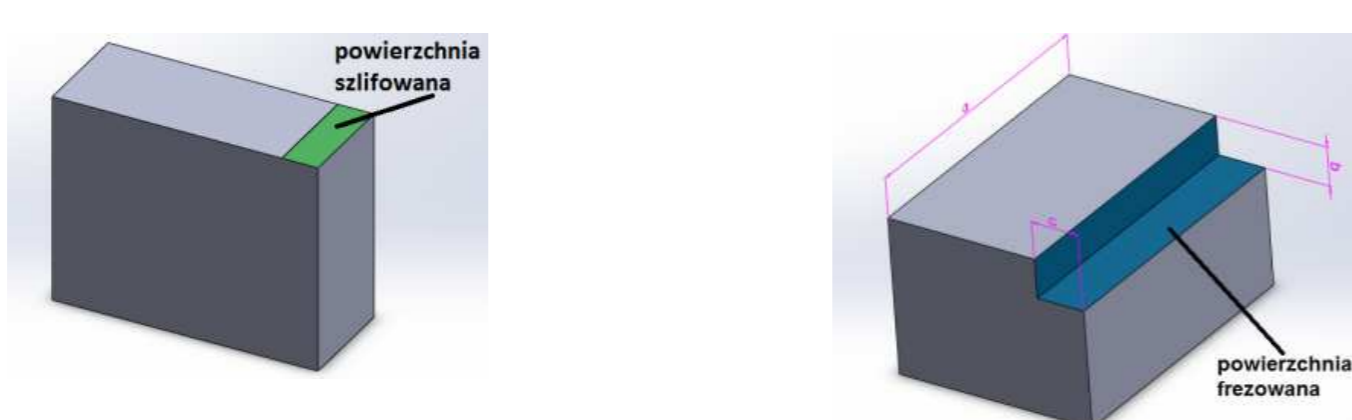


Fig. 4. Shape of milled and ground samples

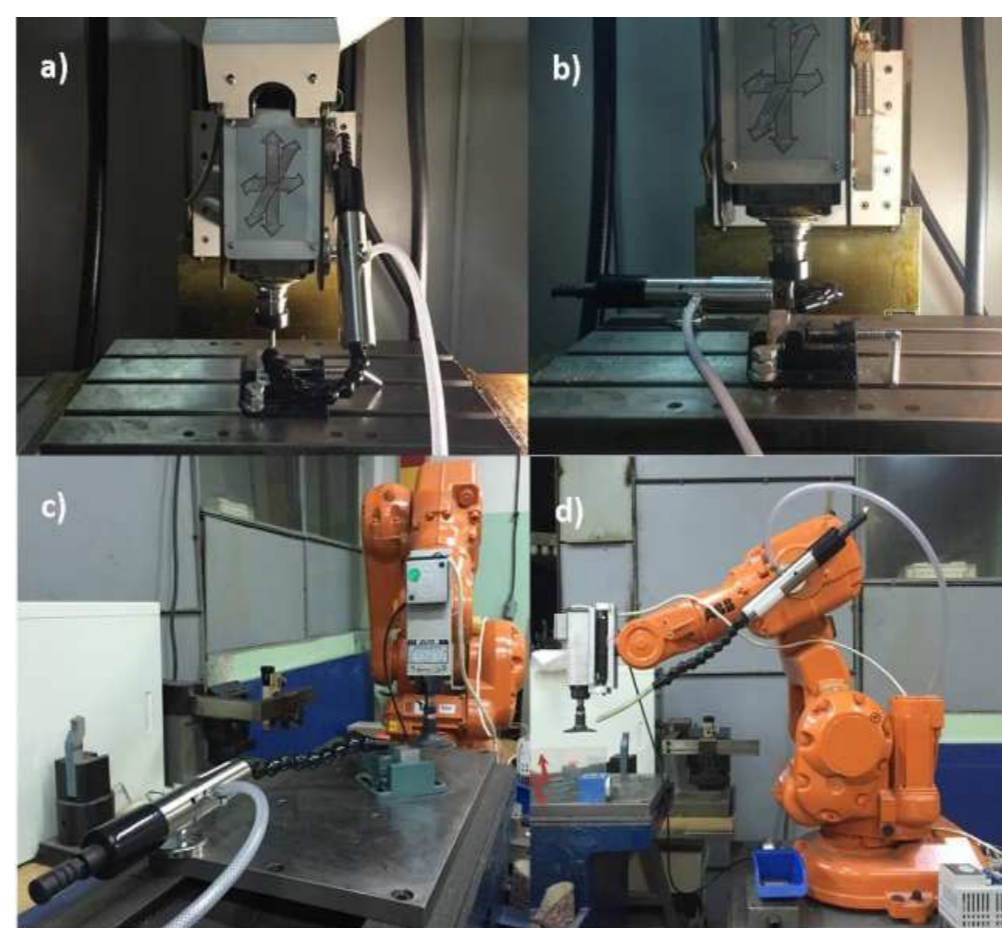


Fig. 5. View of individual workspaces [3]

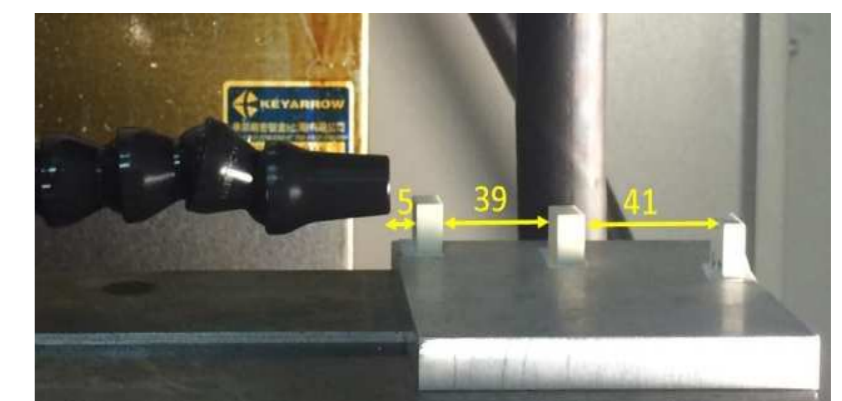


Fig. 6. How to place samples [3]

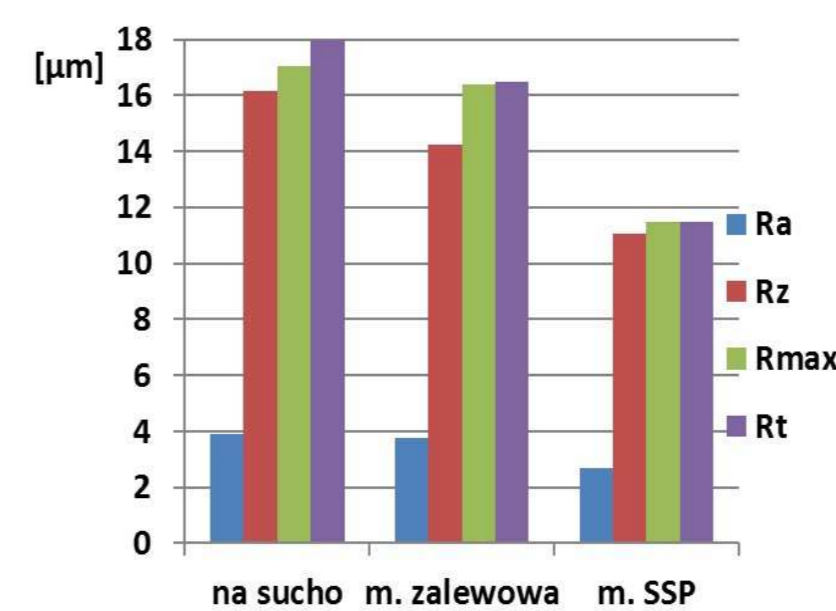


Fig. 7. Results after grinding alumina ceramics

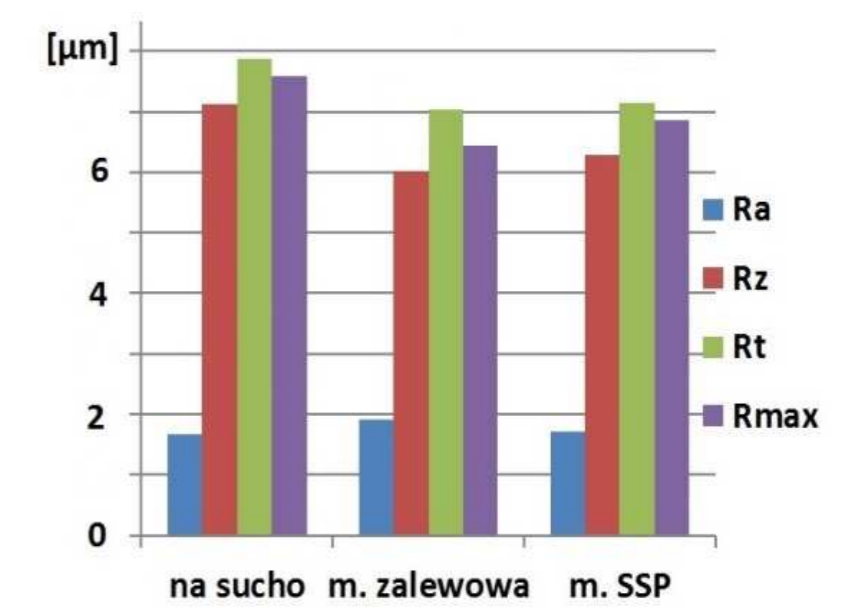


Fig. 8. Results after milling aluminum

Conclusion

- The use of the SSP cooling method, as demonstrated by research and literature analysis of this issue, can extend the life of the machining tools. Both in terms of abrasive treatment (grinding of the active surface of grinding wheels) and state of cutting blades.
- The use of compressed air for cooling the working area of technological equipment and machining zone is an ecological solution. Minimizes the use of coolants (both synthetic and natural based). It does not require disposal of these substances.
- The use of the SSP can be combined with other methods by creating hybrid solutions that enable the machining process to be intensified in a wide range of applications and including a variety of workpieces.
- The disadvantage of using SSPs may be the susceptibility of some thermal shock workpieces caused by intense air cooling, which can reach temperatures of up to several degrees below zero.

Literature:

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