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Strategy of implementation of innovative impregnated grinding wheels for grinding hard-to-cut materials

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Summary

This paper presents a strategy for implementing innovation in a company. This strategy deals with the implementation of innovative impregnated grinding wheels for grinding hard-to-cut materials. As part of the development of the implementation strategy for innovative grinding wheels, an FMEA implementation risk analysis was conducted. The constant competition on the sales market forces the manufacturers to look for new solutions both in terms of production and features of the offered products.

The implementation of innovation in the enterprise must be preceded by various types of analysis and simulations. Conducting an analysis of the risk of implementation allowed to some extent to predict the consequences associated with the process of introducing a new solution.

Introduction

The development of industry has led to the search for newer and newer solutions in terms of materials used. Materials were sought to be more durable and resistant to various factors, both physical, chemical and atmospheric.

This paper develops a strategy for implementing innovative abrasive tools for grinding difficult-to-cut materials at Andre Abrasive Articles. In this work FMEA implementation risk analysis was conducted This analysis is necessary to be done, during the process of implementation of innovative solutions to the enterprise.

Sulphur impregnated grinding wheels

Sulphur is mainly used as an additive to cutting fluids or as a coating impregnant for grinding wheels. It decreases the intensity of workpiece adhesion to the grinding wheel surface and increases the service life of the wheel.

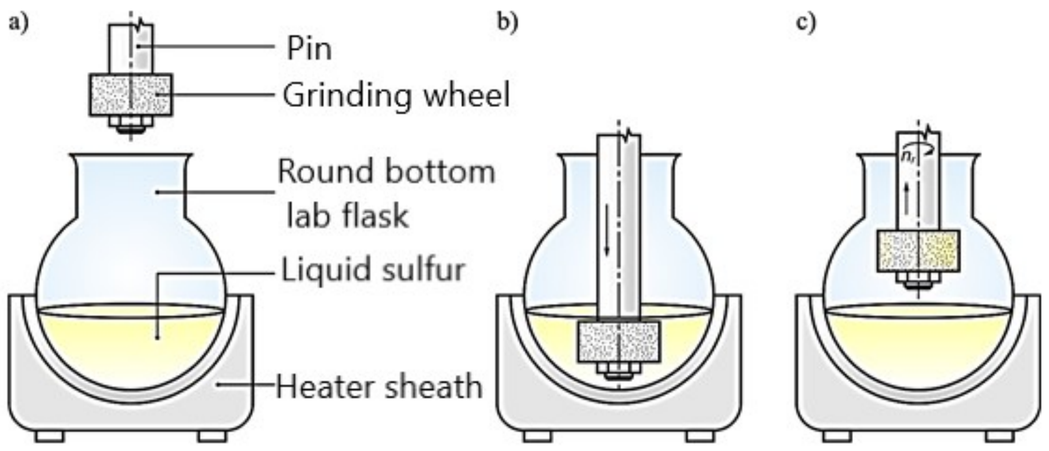

Fig. 1 Diagram of a grinding wheel sulphuring station: a) components of the station; b) setting during sulphuring; c) setting during centrifuging

Map of the implementation process

A process map is a tool used, among others, to present successively consecutive operations or production stages. It allows to easily present relations between individual processes/steps.

The process map shown below (Figure 2) depicts the procedure for implementing innovative impregnated grinding wheels for grinding hard-to-cut materials at Andrea Abrasive Articles.

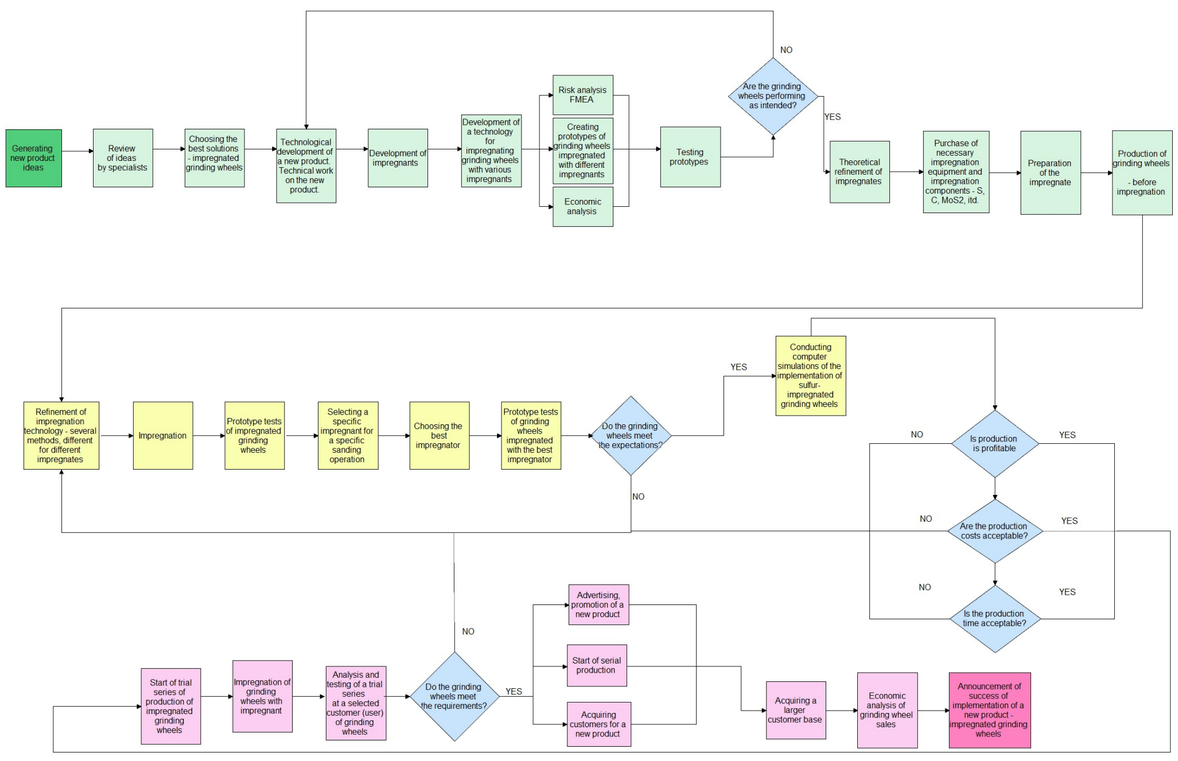

Fig. 2 Map of the implementation process

FMEA risk analysis of the implementation of innovative impregnated grinding wheels for grinding difficult-to-grind materials.

The risk analysis of the implementation of innovative impregnated grinding wheels for grinding hard-to-cut materials was developed using the risk index. This index is described by equation (1).

$$R = O \times Z \times W$$

R – risk occurrence rate,
O – detection rate of error,
Z – significance of the error,
W – probability of error occurrence.

The abrasive tool manufacturer accepts a risk index up to a value of 150. Therefore, in the table below (Table 1), risk index values exceeding 150 are highlighted in red.

Hazard number	Potential risk	Potential effects of the threat	Potential causes	Z	O	W	R
1	Tool with incorrect cutting properties.	The need to convince operators of the innovation, presenting its benefits.	Initial contact with this type of tool.	10	5	6	**300**
2	Incorrect tool size for the machining task	Tool failure, improperly machined material, operator injury.	Improper selection of tool for machine and material.	10	3	3	90
3	Tool life too short.	Faster tool wear, increased grinding operation time, increased costs of operation.	Incorrect tool type or amount of impregnating agent used.	8	5	4	**160**
4	Difficulty in acquiring sufficient tools relative to production plans.	Disruption of the production program, extended job lead time.	Complications in obtaining impregnating substances.	7	3	4	84
5	Implementation of tools into existing technology too difficult.	Disturbances in the production program.	Occurrence of difficulties in regeneration of grinding wheels.	3	4	4	48
6	The need for specialized training of grinding tool operators.	Additional time devoted to training of workers and possible delays in the start of the grinding process.	Occurrence of difficulties in regeneration of impregnated grinding wheels and selection of treatment parameters.	5	3	5	75
7	Tool and technology cost too high compared to the status quo.	Increase in unit production costs.	High cost of impregnated tools.	5	4	7	140
8	Concern about the application of innovative technical and technological solutions.	The need to convince operators of the innovation, to present its benefits.	Initial contact with this type of tools.	4	5	5	100
9	Different machining results than expected.	Incorrect condition of the machined surface, especially of the surface layer.	ncorrectly selected tool type or the wrong quantity of impregnating substances used, as well as incorrect selection of processing parameters.	6	4	5	120
10	Threats to operators	Tool failure	Non-uniform filling of the grinding wheel with impregnant, poorly selected technical characteristics of the tool, improperly selected machining parameters and conditions.	6	8	4	**192**

Table 1. FMEA risk analysis of the implementation of innovative impregnated grinding wheels

Conclusion

On the basis of the above FMEA analysis of the risk of implementation of impregnated grinding wheels, it can be observed that the most probable cause of the risk is an incorrect selection of the type and also an inadequate amount of impregnating substance. Improper impregnation results in a tool with improper cutting properties. This can lead to tool damage as well as reduced or no machining results. The risk index of incorrect selection or inappropriate amount of impregnant is 300, which is the highest value of the overall risk index in the FMEA analysis for the modification of ceramic abrasive tools.

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