

A STATISTIC EVOLUTION OF PLASMA BEAM MACHINING INTEREST

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ABSTRACT

This paper presents some aspects regarding the statistic evolution of plasma beam machining interest. In order to identify the directions to which the plasma machining is directed and what are the actual preoccupations in this field, we consulted the *Compendex* databases which contain approximately seven million of recording by over a 5000 technical journals and journals of international technical conferences between 1969 to 2006.

KEYWORDS: plasma, statistic evolution, database

1. INTRODUCTION

The plasma beam machining (PBM) are complex processes that are used in machine manufacturing field due to their possibilities to process some hard and very hard materials (alloys), with maximum of technical and economical efficiency [7; 8; 9]. Thus, stainless steels, manganese steels, titanium alloys, copper, magnesium, aluminum and their alloys, cast iron and chemical industry toxic waste (by transforming into the marketable products) can be worked.

This method can be used with economical and technical advantages, but this involves the development of full studies and ample theoretical and experimental researches among all the technological system's links, in order to establish (choose) the optimal processing variant.

In the machine manufacturing industry, the plasma, as a "tool", is used especially in cutting operations, coating, welding, melting, and assistance of the mechanical processing operations such as: turning, threading, drilling, grooving etc., in order to improve the machinability of various materials [8].

2. THEORETICAL CONSIDERATION

The plasma/ion beam machining is based on the thermal or chemical effects generated in the contact zones between ions or plasma and the accessible surfaces of the workpiece [7]. The electric energy is used to form the jet of plasma in the presence of a plasmogen gas.

The *plasmogen gas* (primary gas) must accomplish the following conditions:

1. Ensure protection to the incandescent electrode against the oxidation process;
2. To be neutral toward the material of workpiece.

The mono-atomic inert gases, which are today the most used to produce thermal plasma (Argon, Helium, Azoth, air etc.), accomplish these conditions.

Since the thermal energy is delivered in the process, the material in solid state is warm, melts and boiled. The interatomic material bond-breaking is realized by thermal way.

The plasma is a state of matter similar to a gas, but it is characterized by a high level of dissociation and ionization; on the whole, it behaves as a neutral medium.

Plasma is characterized by:

- a high electric conductivity;
- a very good interaction capacity with the electric and magnetic fields;
- permanent source of large spectrum electromagnetic radiations with (infrared, visible, ultraviolet).

In the machine manufacturing field, plasma with a temperature between 6000...30000 °K is used.

In Romania, ample researches concerning the utilization of thermal plasma in machine manufacturing engineering were made at The Institute of Technological Research for Machine Manufacturing Bucharest, at some of the technical universities such as Polytechnic University

Bucharest, Polytechnic University Timisoara etc.

Important researches were also developed and finalized with doctoral thesis by: Alexandru Vas (1971), David Popovits (1972), Ladislau Sandor (1984), Lucian Grama, Liliana Popa (1997) etc. [1, 2, 3, 4, 5, 6]

3. STATISTIC EVOLUTION OF THE RESEARCH REGARDING THE PLASMA BEAM MACHINING PROCESS

By accessing the most important technical database: *Compendex*, available at the following address: www.engineeringvillage2.org we can identify the directions to which the plasma machining is directed and what are the actual preoccupations in this field also.

Compendex database access is provided by the Engineering Village. Engineering Village is the premier web-based discovery platform meeting the information needs of the engineering community.

So that this site has become the globally accepted source of choice for engineers, engineering students, researchers and information professionals by coupling powerful search tools, an intuitive user interface and essential content sources.

This *Compendex* database contains approximately seven million of recordings by over a 5000 technical journals and journals of international technical conferences began with 1969 to 2006.

The database being kept updated weekly covers over the 175 disciplines and major specializations in the big family of engineering. In this paper, the plasma machining processes, such as: plasma cutting, plasma welding, plasma melting, plasma coating etc., were analyzed by means of the numbers of *Compendex* published articles.

The search in the *Compendex* database was realized using the following terms: plasma cutting, plasma welding, plasma coating, plasma melting etc.

Figure 1 shows the evolution of plasma cutting process interest, based on the information found in the *Compendex* database, taking into consideration the number of

published articles concerning the plasma cutting process.

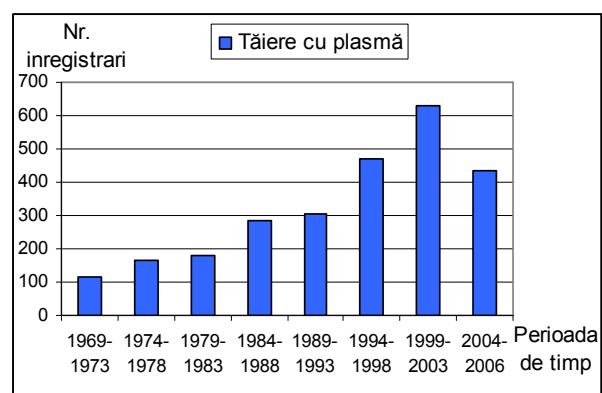
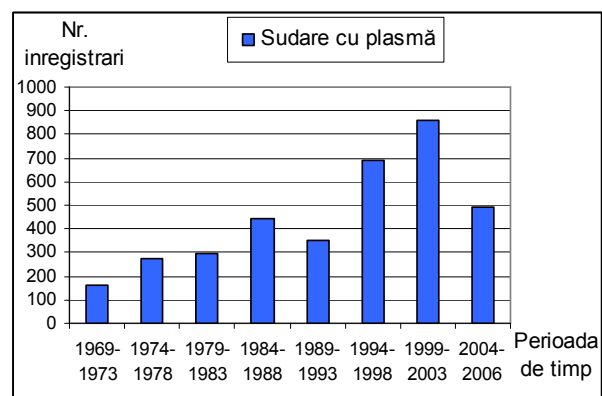
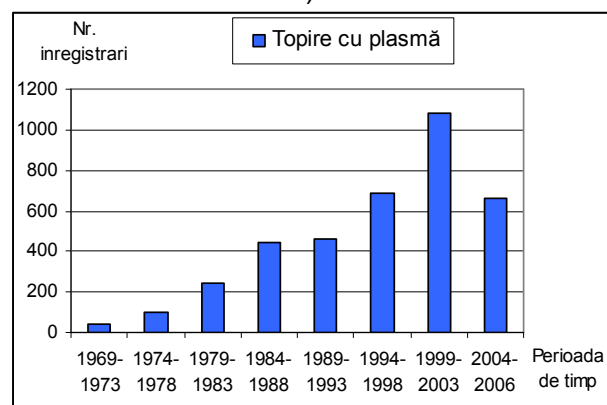


Fig. 1. Evolution of plasma cutting interest

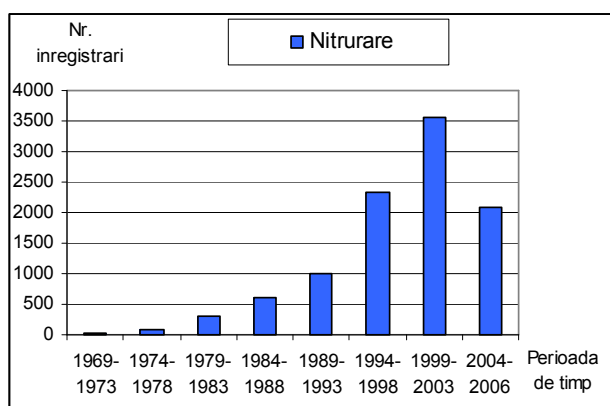
In the case of plasma cutting process, the increase of interest manifested by specialists is visible. Thus, if, in the period of 1969 – 1973, in the *COMPENDEX* database appears only approximately one hundred registrations, in 1999 – 2003 appears approximately six hundred registrations.



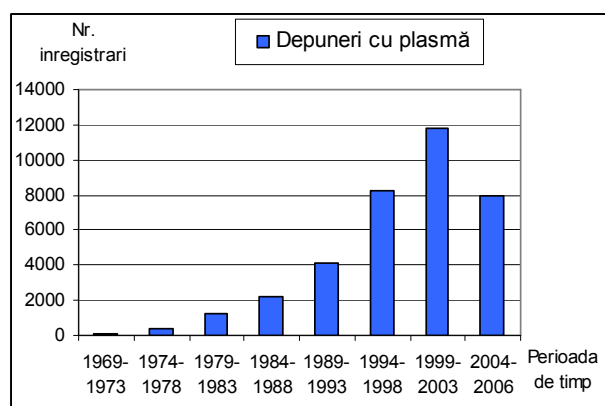
a)



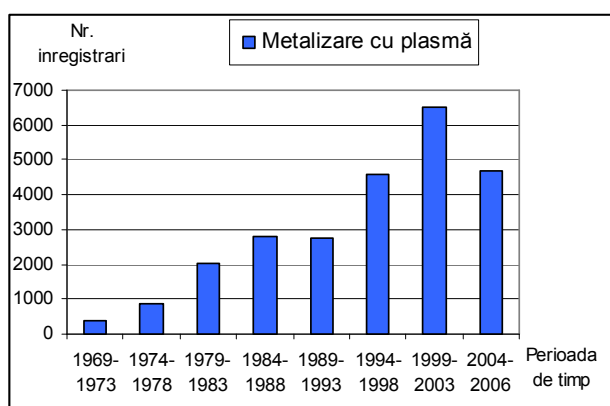
b)



c)



e)



d)

Fig. 2. Statistic evolution of different methods of plasma manufacturing processes (a - welding plasma, b - plasma melting, c - plasma nitriding, d - plasma metallization, d - plasma coating)

Figure 2 shows the evolution of different methods of plasma manufacturing processes, such as: plasma melting, plasma welding, plasma nitriding, plasma metallization, plasma coating.

It is revealed the constant evolution of plasma manufacturing processes.

The interest for this research area of fabrication means that the PBM processes are more and more used in the field of nonconventional technologies due to their possibilities that presents comparing with classical technologies.

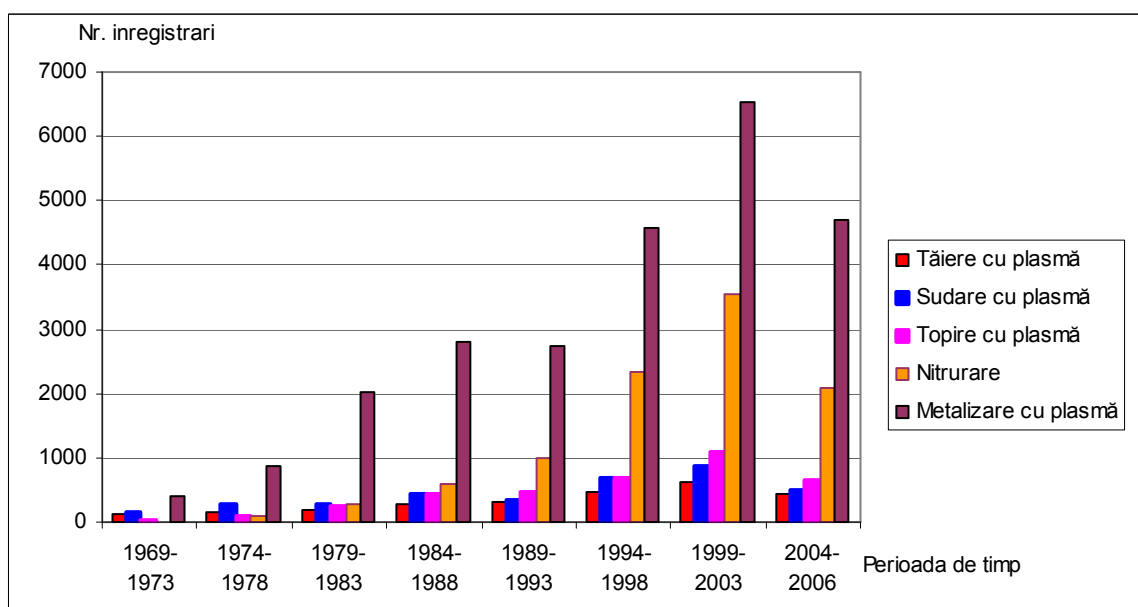


Fig. 3. The statistic comparative evolution of different types of plasma machining processes

As it is shown in figure 3, the plasma metallization has achieved the biggest evolution regarding the number of publications in this field (approximately 6500 registrations in the period of 1999 - 2003). This is followed by the plasma nitriding processes that achieved in the period of 1999 – 2003, approximately 3500 publications in the COMPENDEX database.

The plasma welding processes, the plasma cutting and the plasma melting processes archived a very smooth evolution compared with the other two processes, namely: plasma metallization and plasma nitriding.

4. CONCLUSIONS

Based on the above mentioned aspects, we can conclude that the field of plasma manufacturing processes presents a growing tendency regarding the manifested interest of the specialists from this field. This is shown by the articles published by them in this area of interest

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