Archives of Materials Science and Engineering

Volume 31
Issue 1
May 2008
Pages 57-60

International Scientific Journal
published monthly by the
World Academy of Materials
and Manufacturing Engineering

Teaching the plating of surface layers using an E-learning platform

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Received 28.02.2008; published in revised form 01.05.2008

ABSTRACT

Purpose: The aim of this paper is to present the role of e-learning tools in the process of students teaching within the area of material science, on the base of an e-platform for teaching students the processes of surface layers plating. Nowadays classical teaching tools are replaced with computer tools presenting analyzed processes and structures in a virtual space so the purpose of the work is also to present a form of comparison of these approaches.

Design/methodology/approach: The presented results base on the elaboration and investigations of the e-learning program for Polish students helping them to understand the process of surface layers plating. The program has been checked according specific educational requirements of the educational process of a technological university.

Findings: Results obtained in the work point the importance of application of an e-learning platform in an educational process of the material science students. Also the methodology of creating such e-learning platforms and their educational estimation are presented.

Research limitations/implications: The main limitation is related with the analyzed manufacturing process: surface layers plating. Moreover the subject has been limited to the group of main galvanic layers, as this work is a result of investigations in the area of galvanic layers electroplating. Secondly the project takes into account only the layers that are the most characteristic and are the most spread in the industry for the described electroplating technique.

Practical implications: The first practical implication of these researches is the possibility for offering a wider scope of materials on the educational platforms prepared for the new university e-learning system. Secondly, it is possible to use these materials in consultations offered for industrial plants in the system of commercial cooperation of the university.

Originality/value: The work presents the original e-learning program for teaching the students of material science. In the process of preparing the program some interesting solutions consider with visualization techniques have been done.

Keywords: Computer aided teaching; E-learning

1. Introduction

The surface layers plating university course in a conventional educational process requires expensive laboratory tools and also needs cooperation with industrial plants to introduce the students with the taught processes of surface layers plating.

Not all processes could be presented during laboratory activities because some of them are dangerous or must be conducted in special conditions. So it is needed to propose another way of presenting such processes during an educational process. This need requires the change of an educational process and should results in decreasing the costs of educational system

and better understanding of taught processes. Students should familiarize with all elements of manufacturing process. Moreover they should simulate their runs to gain the technological experience. They can also examine the causes of faulty runs of manufacturing processes using special virtual models of the manufacturing environment [1-4].

2. Galvanic layers plating

The process of electroplating is performed in special protected rooms (Figure 1) what is related with the influence of chemicals being the base of the galvanic bath [5-7]. It is one of the factors that force to elaborate the other way of presenting this technology. Secondly special, automated processes (Figure 2) need a special sterile atmosphere and somebody's presence could strongly affect the conducted plating process.

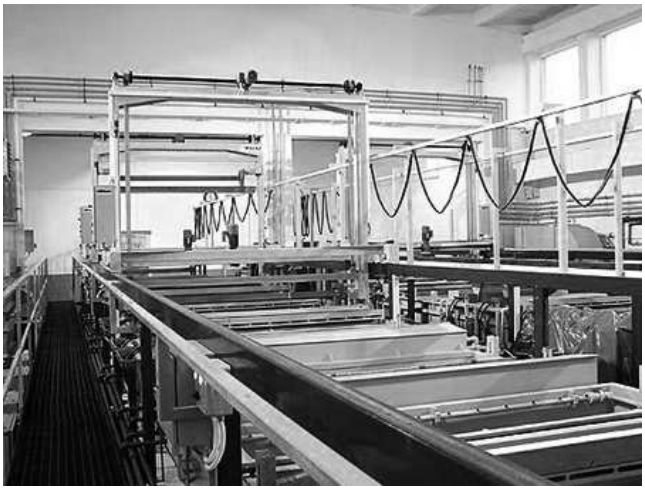

Fig. 1. Electroplating production line

Fig. 2. Automatic electroplating production line

The electroplating process itself consists of some important phases: jigging, pre-processing, plating and drying (Figure 3). During the first stage plating materials are placed on special hangers (for processes conducted in cylinders they are not needed). The next stage, pre-processing, consists of: cleaning and degreasing.

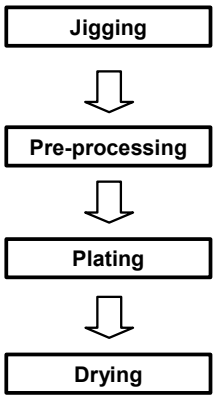

Fig. 3. Scheme of operations of plating [8]

The main technological process is plating (when performed on the base of chemical processes) or electroplating (for electrochemical processes). This process could be single (or plating one layer) or repetitive (for plating some layers of different metal: cuprum and nickel for example). It is conducted in special tanks or perforated, rotating cylinders (Figure 4) for plating small elements.

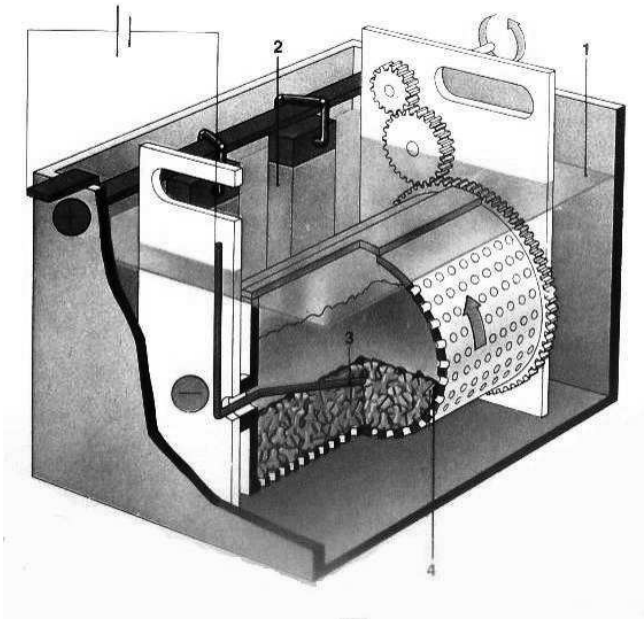

Fig. 4. Scheme of operations of plating [9], 1 - electrolyte, 2 - anode, 3- cathode, 4 - rotating cylinder

During the last operation the plated elements are dried. In this stage it is also important to protect obtained layer against loads and aggressive substances. Next products are packed and prepared to dispatch. It must be stated that in some cases the galvanic layers are the base for layers deposited in other processes, for example CVD or PVD [10-12].

3. E-learning program description

The structure of the presented program (Figure 5) corresponds with basic trends for educational programs. The program is divided into two main parts: multimedia presentation of the analyzed material and special control test (the last button on the main page). On the right side there are the control buttons characteristic for all internet applications. It must be stated that originally the program has been elaborated for Polish students.

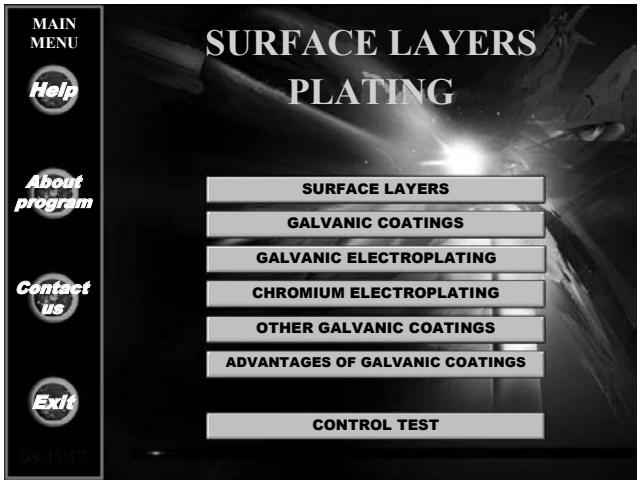

Fig. 5. Main window of the program

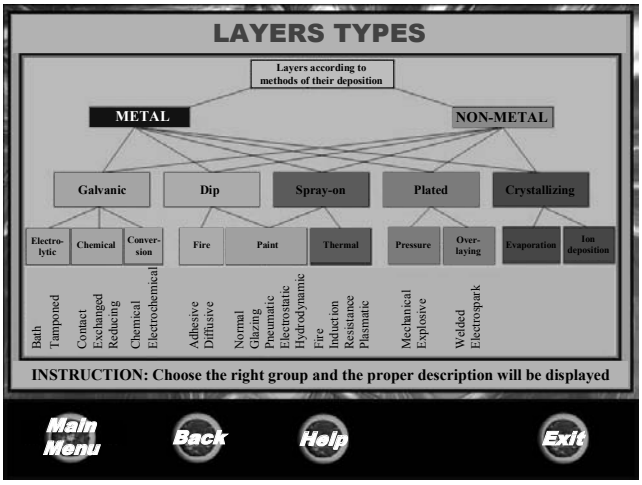

Fig. 6. Window with classification of surface layers

The educational part of the program includes a presentation of general information about surface layers deposition to place correctly the galvanic layers plating among other techniques and to compare different methods (Figure 6).

The description of the galvanic layers deposition includes both a theoretical introduction (Figure 7) and practical examples. The introduction presents chemical processes during a plating. It helps also to find information about related techniques.

Apart from theoretical information the program presents also information about technology of plating. Students can follow the visualization of the process, familiarize with equipment used for plating or acquire information about layers parameters and its utilization (Figure 8).

The exemplar process is prepared for the nickel layer. But students can also know other electroplating processes (Figure 9) presented comparing with the base nickel plating.

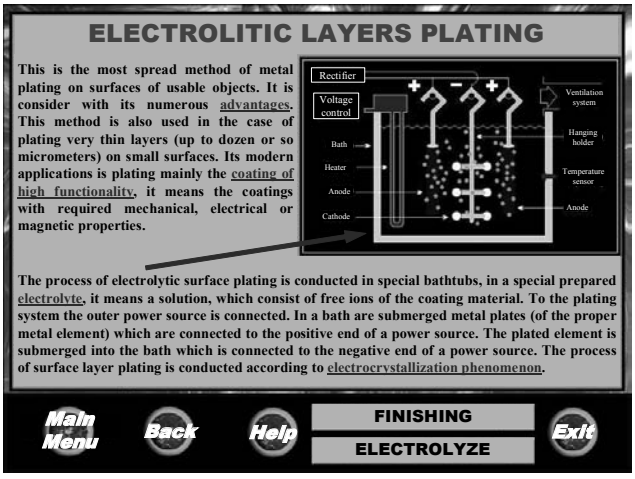

Fig. 7. Window with theoretical introduction to galvanic processes

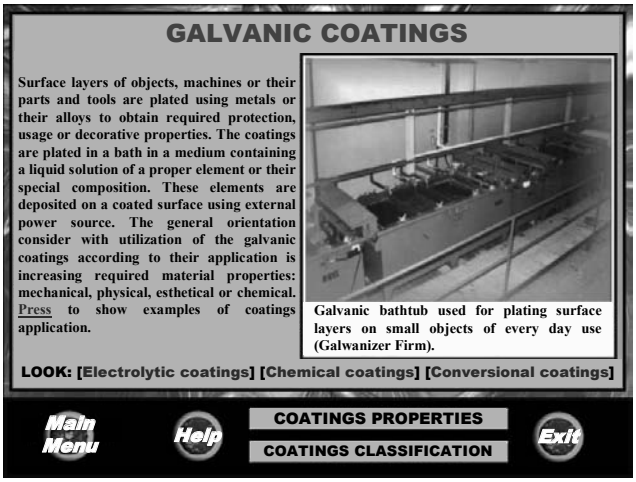

Fig. 8. Window with description of layers parameters

Fig. 9. Window presenting other galvanic processes

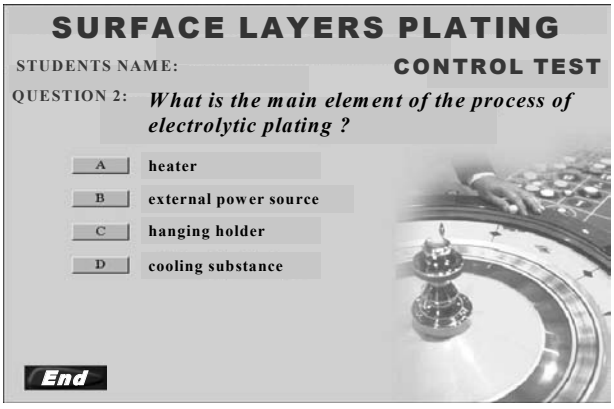

Fig. 10. Window presenting the test page

The presented program includes all information needed to understand the mechanism and technology of the electroplating. Also it is possible to know the influence of process parameters on obtained layer factors. Moreover the program includes information about product requirements consider with plating process what helps in self process designing [13-15].

4. Conclusions

Finalizing the description of the presented e-learning program for courses consider with galvanic processes it has been stated that it is fully interactive. Students could navigate both with icons and with hyperlinks (like in a network encyclopedia). It makes the educational process easier and more friendly.

The next advantage of the program is its inner control module (Figure 10) which makes possible to check students' knowledge.

References

[1] E. Bociaga., T. Jaruga, Vizualization of melt flow lines in injection moulding, Journal of Achievements in Materials and Manufacturing Engineering 18 (2006) 331-334.
[2] S. Topolska, D. Szewieczek, The visualization of manufacturing process of pipes welding, Journal of Achievements in Materials and Manufacturing Engineering 20 (2007) 575-578.
[3] J. Adamczyk, Manufacturing of mass-scale products from structural micro-alloyed steels in integrated production lines, Journal of Achievements in Materials and Manufacturing Engineering 20 (2007) 399-402.
[4] M. Gumińska, J. Madejski, Scaleable model of E-learning Platform, Journal of Achievements in Materials and Manufacturing Engineering 21/1 (2007) 95-98.
[5] M. Blicharski, Material Engineering. Steel, WNT, Warsaw, 2004 (in Polish).
[6] T. Karpiński, Production Engineering, WNT, Warsaw, 2004 (in Polish)
[7] S. Topolska, Characteristic defects of metallic coatings obtained in the metallization process, Comment Worldwide Congress on Materials and Manufacturing Engineering and Technology, Achievements of Mechanical and Materials Engineering, Gliwice – Wisla, 2005, 675-680.
[8] S. Topolska, Analysis of the technological process of rings of train wheels, Journal of Achievements in Materials and Manufacturing Engineering 17 (2006) 405-408.
[9] T. Rodgers, Professional Manual of Electroplating, Univ Pub House, New York, 1993.
[10] L.A. Dobrzański, L. Wosińska, J. Mikuła, Investigation of hard gradient PVD (Ti, Al, Si)N coatings, Journal of Achievements in Materials and Manufacturing Engineering 24/2 (2007) 59-62.
[11] J. Mikuła, L.A. Dobrzański, PVD and CVD coating systems on oxide tool ceramics, Journal of Achievements in Materials and Manufacturing Engineering 24/2 (2007) 75-78.
[12] M. Rojek, J. Stabik, Modification of PVC compounds with butadiene-acrylonitrile elastomers, Journal of Achievements in Materials and Manufacturing Engineering 17 (2006) 141-144.
[13] L.A. Dobrzański, Metal Engineering Materials, WNT, Warsaw, 2004 (in Polish).
[14] A. Gwiazda, Quality tools in a process of technical project management, Journal of Achievements in Materials and Manufacturing Engineering 18 (2006) 439-442.
[15] E. Shevtshenko, T. Karaulova, S. Kramarenko, Y. Wang, IDSS used as a framework for collaborative proects in conglomerate enterprises, Journal of Achievements in Materials and Manufacturing Engineering 22/1 (2007) 89-92.