Materials of Conferences

MODERN FEATURES OF DEVELOPMENT MEDICAL INFORMATION SYSTEMS

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In the next two years on the implementation of modern information systems in health care is assumed by the Russian government to send about 24 billion rubles. Topical is the study of tendencies of development of modern medical information systems (MIS). We have attempted to analyze and to point out some features of the development of modern MIS. They have been studied and analyzed 190 MIS. The main sources of information were: Internet, medical and specialized periodicals, monographs and scientific conferences, forums and exhibitions. IIA classification by purpose has been spent. All systems were divided into two classes: diagnosis and treatment, and the rest.

During the study period, since 1998, it has been an increase in the share of medical-diagnostic ISI in relation to other systems.Therapeutic and diagnostic systems account for 32% in 2016 in relation to the total number of MIS. In 1998, the share of these systems was about 10%, in 2005 – 18%. The main share studied MIS (190 software products, 54 firms of developers) take diagnostic and treatment (32%), organizational and economic (14%) and complex (12%). As for the amount of introduction of information systems for medicine, then we can speak of a greater use of organizational-economic general purpose and specialized MIS solutions for the management and administrative tasks. The reasons for the imbalance in the provision of information needs physicians and administrative staff are considered to be high cost-priobre plants are, the reluctance of doctors to learn to work with your computer, use the inconvenience (suitability) IIA medical staff and its functionality. There is a significant gap between the information systems of health care institutions (MPI) for the doctor and for the administration.

Most urgent and challenging development MIS is to develop support systems decision making (CDSS) doctor. CDSS in medicine (health care) – this is problem-oriented system (or hardware and software systems), implementing information technology to support decision-making processes of therapeutic and diagnostic and / or administrative decisions by medical personnel. The need for application of CDSS arises in the case of limited resources, lack of time, experts deficit, uncertainty of information about the world and the object under study. This situation is typical for the majority of decision-making problems in medical diagnosis and treatment, in particular in the fields of high-tech medical care.

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THE PHENOMENON OF REDUCTION IN STRENGTH OF HARD-COATED CUTTING TOOLS AND THE CONDITIONS FOR ITS OCCURRENCE

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The article presents a summary of well-known facts on reduction in strength of metal cutting tools with diamond like carbon (DLC) coatings.

The last decade saw an increase in the usage of hard coatings of the diamond-like carbon (DLC) type and ones similar to them. As a rule, they are applied by dispersing coating materials (for example, graphite) in a vacuum with a cathode and depositing them over the working surface of a tool [1–2]. They are fastened on the surface by means of adhesion, without infiltration into it.

Today, significant experience has already been gained from the usage of cutting tools with hard coatings, DLC coatings, in particular. As a whole, the experience is positive, but the accumulated data is uncoordinated and, as a rule, presents results for a specific case only. If there are negative results among them, they are usually deemed to be accidental, caused by errors during either the experiment itself or mathematical treatment of its data.

In view of the above, the authors conducted at the Department of Metal Cutting Machines and Tools of the Ural Federal University an analytic research the goal of which was to generalize currently known facts and figures on the efficiency of tools with DLC coatings, to study deeper negative examples of their usage, and to find out reasons behind those negative outcomes.

The research studied data on the wear and wear resistance of end milling and disk milling cutters, lathe tools, drills of 0,5–2,5 mm in diameter and knives of guillotine shears [3–9]. The methodology of the research was based on the analysis of reliability of the mathematical models which describe the dependence of tools wear on duration of their usage in various combinations of cutting modes and for various machined materials. Also, other sources of data were used, like the one from metallographic examination of the structure of tools before and after they have been used, and also the results of the microscopic examination and profilography of the surface of tool cutting parts.

Thus, the following facts were established:

1. DLC coatings indeed reduce the wear and increase the resistance of cutting tools by 3–4 times within the whole range of cutting modes recommended by «The Reference Book for Production and Mechanical Engineers» [10] for fine-turning and milling operations.

2. In rough-turning or milling operations, on the contrary, the wear rate of DLC-coated tools turns out to be 3-4 times higher than that of uncoated tools.

3. In those operations when holes are machined with drills of 4 mm or more in diameter using the modes recommended by the reference book noted above, the wear of tools also decreases, similar to fine-turning and milling.

4. In those operations when holes are machined with drills of small diameter (up to 2,5–3 mm), the DLC coating contributes to a substantial tool life reduction, causing their breakage.

5. In those operations when metals are machined at high speeds by means of turning, milling or drilling, the strength of DLC-coated tools turns out to be higher than that of uncoated tools.

6. In those operations when thin-sheet metals are cut with guillotine shears, holes are reamed, other types of machining at low speeds of cutting (except those mentioned in paragraph 2 of this list) are used, the strength of cutting tools increases by 2–5 times after having them DLC-coated.

The physics analysis of cutting with DLC-coated tools and its comparison with the conditions of machining noted above allow us to state that those situations when using the coating gives no result or affects negatively are nonrandom at all. There exists quite an evident phenomenon of the reduction in strength of tools which have been DLC-coated, and the reasons behind it are quite specific.

The first one of those is a high brittleness of the coating. In rough-milling or turning operations, the impact of considerable forces of cutting and the deformation of the undercoat (however small it is) cause breakage of the coating and formation of chips and fly grit in the area of cutting. The grit, in its turn, increases the wear rate mentioned in paragraph 2 of the list above.

The second reason is the increase of tool surface roughness and the «tool-detail» friction coefficient. Nowadays, it is commonly accepted that this coefficient decreases after the coating have been applied. This conclusion is made from those experiments when a surface, with or without the coating, is acted on with a small but very hard ball. By the trail size of such a ball, they assess the coefficient – a harder surface is obviously indicated by a smaller trail. Which leads to the conclusion noted above. But, in reality, it is true only for the coefficient of rolling friction, and not as much so for the one of sliding friction, and the «tool-detail» pair is characterized by the latter. The coefficient of such friction increases after having a hard coating of the DLC type applied to the surface. That is because graphite, while being dispersed with a cathode, settles unevenly on the undercoat and forms significant microirregularities whose depth exceeds by more than 50 times the depth of irregularities of a polished undercoat. This leads to the increase of the friction coefficient by more than 30% [1–2]. But such an increase of the coefficient and, accordingly, the friction force results in a corresponding rise of cutting forces. And if stress in the tool body exceeds the strength limit of this tool, it breaks. That is the reason behind the breakage of drills of small diameters mentioned in paragraph 4 of the list above.

Thus, the cases of the decrease in strength of DLC-coated cutting tools are quite natural and caused both by some peculiarities of their usage and certain specifics of how the coating is applied. However, one can find ways of combating the phenomenon. For this, special measures should be taken to prevent the increase of surface roughness when applying the coating to fine-sized tools, such as drills of small diameters.

Such measures could include oxygen-based ion etching of the coating just after it has been applied (proposed by the authors of the article as early as in 1998 in paper [4]), laser-based pulse vaporization [11], magnetic separation of the dispersed graphite (proposed by the «CreepService Sarl» company from Switzerland [12–13] and used by the «New Plasma Technologies» company since 2011). Also, you cannot use DLC-coated tools for rough or high-speed cutting machining. Although the forces of cutting at an increased speed, as a rule, decrease, the temperature of cutting rises and the structure of the coating changes [1–2]. This explains the inefficiency of the coating noted in paragraph 5 of the list.

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ENERGY-SAVING AND ELECTROCHROMIC GLASS OBTAINED BY EXTRACTION-PYROLYTIC TECHNIQUE

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Recently the usage of transparent conductive film (TCO) is growing rapidly. The most popular transparent and conductive oxide is indium tin oxide In_9SnO_{15-x} (ITO). ITO films have a high light transmittance in the visible spectrum, good electrical conductivity, hardness and chemical inertness. They can be widely used in the construction and automotive industry, provided that they obtain a low-cost large-scale method. ITO film reflects infrared rays and they can be used it as a thermal barrier coating on the window panes [1].

The application of TCO films as transparent electrodes for electrochromic glass is actual. Electrochromic glasses are used in the buildings and window and offices dressing, automobile industry for the auto-dimming rear-view mirror of the car. Electrochromic glass reduces the heat loss and costs of air conditioning and lighting. They are an alternative to mechanical shutters and shading screens or curtains. Absorption or reflection of light in the visible and near infrared region is regulated by the electric field applied. Dynamic control of sunlight and infrared radiation can significantly reduce energy consumption in hot summer and cold winter conditions. But now the electrochromic glass has a relatively high cost.

To reduce the cost of the electrochromic glass need to develop the low-cost technology of their production. Availability of raw materials and the cost of manufacturing method are important factors in the manufacture of functional materials. The choice of method is generally associated with optimal operation considering of thin solid film for a particular use and minimizing manufacturing costs.

Oxide films traditionally deposited by vacuum sputtering of targets heated to high temperatures [2]. Now developed larger machines with complex processes of measurement and control systems to stabilize the reactive sputtering process. The method of laser sputtering [3] allows to spray almost any composition of the target. Ionic plating method [4] uses a fully automated vacuum chamber with a cryo-pump equipped with analytical devices. Sol-gel method [5] can be used to produce quality films with a wide possibility of changing properties with changing the solution composition.

Physical and chemical properties of the resulting film (resistivity, optical transmittance, surface roughness) correspond to the method of deposition and process conditions. Properties of oxide films is determined by technological factors which ensuring the homogeneity of the material and stoichiometry. In particular, the extraction-pyrolytic method provides the mixing of components in solution in a given proportion and maintaining the stoichiometry of obtaining materials.

This paper describe the transparent conductive films and electrochromic glass obtained by extraction-pyrolytic method [6]. Extracts of metals are characterized by low content of impurity elements at the level of 5.10 mg / l and the adjusted concentration unchanged during storage.

Materials and methods of research

In this paper, for the synthesis of transparent conductive oxide InSnO films and electrochromic NiO films, the extraction-pyrolytic (EP) method [6] has been used. The method consists of the extraction of metals from solutions of inorganic salts for purification from impurities and transfer of the metal to organic phase. The obtained extracts – salts of organic acids – wet the substrate well of any type and form of self-assembled thin film. Metal concentrations in the extracts were estimated by the atomic absorption technique with the AAS-1M device. The organic extracts were mixed in the required stoichiometric ratios and diluted to a predetermined concentration, the most optimal for the formation of thin films.

The films were deposited by rolling of extract on a glass substrate which has been previously cleared. The organic extracts well moistened the glass substrate and form a self-assembled thin film. After drying the wetting film are placed in a open pyrolysis furnace. After drying the substrate, the wetting film was placed in a furnace for pyrolysis in air at a temperature of 450 ºC. Pyrolysis of wetting film results the formation of many nucleation