BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
Publicat de
Universitatea Tehnică „Gheorghe Asachi” din Iaşi
Tomul LXI (LXV), Fasc. 3, 2015
Secţia
CONSTRUCŢII DE MAŞINI

CONSIDERATIONS CONCERNING THE WORKABILITY BY CUTTING OF THE MINERAL MATERIALS AND OF THE RUBBER UTILIZED AS MANTELS AT THE ROLLERS FROM THE PAPER AND BAKERY INDUSTRY

BY

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Received: July 2015
Accepted for publication: October 2015

Abstract. The present paper propose to present the actual stage of the technical and economical of the appreciation of mineral materials and rubber’s processing and of the cutting ability of the tools utilized at the turning and grinding of the ceramic, mineral and rubber mantels of the rollers from the paper and bakery industry.

Keywords: mineral materials, machinability of the mineral materials, cutting capacity, roller with granite mantle, roller with rubber mantle.

1. Introduction

In the specialty literature, composite, mineral, synthesized and ceramic materials are named materials from the second generation (Iacobescu, 2000). These are used successfully in the aerospace industry, in the naval and railwaymen transport, in electronics and electrical, at the energetic machines, in automobile and chemical industry, in constructions, in paper and cellulose

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industry and in many others industries. The apparition in industry of the second generation produces the competition between the technical characteristics of the changed metallic or nonmetallic materials, at the apparition of new manufacturing and design technologies, in order to assure the dimensional precision, the imposed surface quality imposed by the functional role and by the work conditions and by the level of stress. The studies made by the specialists from Mitsubishi and Toshiba shown that the firms that will not take measures to replace the traditional materials with new ones with net superior properties will not survive at the competition (Popp, 1999). At the level of the globe, there are found the biggest reserves of mineral materials. From the field of mineral rocks, for the industry present major importance the basalt, the granite, the marble, the pounce rock, the diamond and the silicon.

Due to the special properties realized from mineral materials, with a natural source, how much more of these that suffered a primary process (sintering, fusion), these materials are utilized from a lot of years in industry as primary materials, and also excellent substitute of the parts and pieces of the ferrous and nonferrous materials (INID, 1990) (allied steels and high allied steels, rustles steels working in intense corrosive environments, of the tribology elements and friction elements).

2. The workability by Cutting of the Mineral Materials

The study of the specialty literature shown the fact that exist researchers in the cutting field that, referring at the workability, consider in fact by this notion the totality of the ensemble of the conditions that characterize the cutting manufacturing (Picoș, 1991). The name of „machinability" called sometimes „workability" was used for the first time in the year 1920, in scientifically communications of Herbert, Rozenheim and Sturney (Picoș, 1991) in order to make evident the correlation between the tool life end the cutting speed, correlation appeared in the paper of F. Taylor „On the art of cutting metal" in the year 1907. The notion of machinability of the materials is intimate connected to the notion cuttingability of the cutting tools, having at the first look common appreciation criteria. In fact, appreciation criteria are in principal similar, but relegate to the different fields. So, the machinability by cutting of a material referees at the machinated material, permitting by consequence the choice of a material that in given conditions to correspond the best to the machinability's criteria appreciation, considering also the economic criteria, and the cutting ability refers at the measure in which a cutting tool correspond to the appreciation criteria to appreciate this ability.

We appreciate that the use of these two notions permit the evident improvement of the economic efficiency of the cutting manufacturing, becoming a technical-economical instrument, important and inevitable in an economical competition activity.

The two notions where defined in the paper (Enache, 2000), but only for metallic materials, existing in the specialty literature only punctual information's about a named material or a précised cutting tool, without considering globally all the appreciation criteria of the two notions in the case of the manufacture of another materials. As consequence, we consider necessary to adapt the two notions at the ceramic, mineral and rubber materials, fact that would permit that in normal working conditions of pieces to choose the best material, or the machining of a material to be realized with the most appropriate cutting tool, in the two cases using optimal cutting operating parameters. The optimization based on the two criteria is made in principal on technical – economic criteria, but it is possible to establish other criteria, considered as important in a given situation.

The machinability of a material or of a group of materials in the analyzed case of mineral materials is gave by the totality of the factors that work together for the obtaining of a piece considering geometrical form, dimensions, surface quality, functional purpose, the mode and the stress request, imposed conditions in which the realized piece will work (Dumitraş&Oprean, 1994). A mineral material is more machine if: the tool life is higher, the time to remove by cutting of a material quantity is shorter, the obtained surface quality is better, the mechanical and energetically request generated by cutting is smaller, the working precision is higher and the chips has a convenient form (Picoş, 1981).

The gamut of the processing of the mineral products is relative reduced, these being characterized by machinability considered as more reduced by comparison with the machinability of the metallic. Almost all products made from mineral materials by classical cutting processes are processed only with diamond or ACB tools (turning tools, grinding tools, milling tools), but for these tools the geometrical and functional parameters where not yet totally defined. The machinability of a material is mainly determined by this hardness. Considering the hardness scale elaborated by Mohs, the mineral materials can be ordered in three groups, offering a good image on the machinability degree: first group – materials with a low machinability (diamond, ACB), second group – materials with a ameliorated machinability (basalt, granite, marble) and the third group, materials with a high machinability (gyps, blacklide).

3. Cutting Process Analyses. Specific Phenomena at the Cutting of the Mineral Materials, Cutting Conditions

The specialty literature offers very few information's and evidently deficient (sometimes approximate) about the cutting parameters used at the cutting of these materials (Grămescu, 2000). For new materials or new applications is evident the fact the all researches concerning the machinability of the mineral materials or rubber, and concerning the cutting ability of the

cutting tools for these materials must be restarted from the beginning. A reason for that action is the fact that for mineral materials cutting processes are indeed different by comparison with the cutting processes of the metallic materials. A first problem is due to the fact that at the manufacture by cutting of the mineral and ceramic materials appears always manufacturing defects (fissures, tears, breakings) of the mineral products, especially in the area of the edges or at the variations of the sections. We appreciate as important to define supplementary criteria of the machinability of the ceramic or mineral materials, different of the criteria used at the metallic materials, in the purpose to obtain machinability indexes at the metallic materials more significant or decisive. It follows that future researches define these new parameters, and the machinability indexes to be correct and completely mathematical expressed. The charge is difficult because the properties of the different ceramic or mineral materials differ very much from a material to another one. In the case of the manufacture of different rubber types problems are more complicated, the differences given by others materials being really significant.

The machine-tools designated to the manufacturing of the pieces made from mineral materials must accomplish a lot of different conditions in contrast with the conditions for the machine-tools to manufacture metallic: they must have a static or dynamic stiffness: to have mechanisms for action with a high power and constant speeds, independent of the charge of the piece, to have a high precision in bearings and guiding, to have efficient devices to protect the moving elements and parts, to have ventilation systems for the elimination of the powders produced in the cutting processes, to have specific devices to catch and fix mineral materials (jaws from lax materials, felt, lead, cooper or other materials to avoid the crack or the fissure of the pieces), to have automatic systems with numerical commands or to be assisted by electronic. These supplementary conditions can influence in a certain mode the discussions about the materials machinability, although the machinability is defined on the same principles as the machinability of cutting, the cutting ability or the work ability of the machine-tools.

Researches in this domain of the reciprocal influences between the three notions seems to be extremely utile and enlightened, fact that could permit to systematize and to objectives the machinability's characteristics, the correct choice of the tools and of the machine-tools for a given product. Some technological realities are sustaining the requirements enunciated up by the authors. So, using the hypothesis that in the case of the materials characterized by high fragility the specific phenomena of the chip formation are similar for any mineral material, it results that the phenomena shown at the glass' cutting process can be extended in the case of the manufacturing of materials having a high (Dumitraş&Oprean, 1994). For example, the experiments and researches realized at the execution of the grade's divisions on a glass rule with a pin in diamond, the scratch shown that if cutting depth and cutting speeds are low it is

realized a continuous flowing chip. If the operation is repeated with a pin with a radius „r" and cutting depth and cutting speeds are the same, the cutting is not realized with a flowing chip, but is realizes as a fragmented chip.

At the processing in the elastic and plastic field of the glass surfaces, it is observed that with the improvement of the cutting parameters (the stress domain), in the area of the formed and of the oust of the chip from the piece surface, at the periphery of the deformed area appear radial fissures disposed normally at the manufactured surface and longitudinal fissures having a tangent orientation at the generated surface by cutting. If the specific charges are low, longitudinal fissures do not appear. It is also observed that the longitudinal fissures generated by the radial stresses from the cutting area are bigger dimensions as the radial fissures formed by the normal stresses. Analyzing the fissures configuration it results that the radial fissures are closed at the terminations (present an elliptical form) and the longitudinal fissures have the form of an arrow. The granulation of the diamond or of the ACB (arming the cutting tool) determined the dimensions and the configuration of the appeared.

In the case of the product from mineral materials with a high toughness and fine granulation, the chips formed by turning, grinding and milling have the form of scale formed by flake or by slipping in the shear plane, as in the situation of the glass. In the case of the holes in mineral materials, the formation of the longitudinal fissures is fewer determined by the cutting method and the effect of the radial fissures has a good character at the cutting operation.

All these observations put in evidence the differences of onset of the notion of machinability for ceramic materials and for rubbers, imposing the realizing of thorough specific researches in this direction.

4. Conclusions

Due to the mechanical, thermal and chemical properties bad as the relative good machinability, the mineral rocks in pure state or in combination with auxiliary materials and liaison bindings are used on a large scale in different industrial fields (machine construction, chemical installations, electronics, electrical, aerospace industry etc.).

The knowledge stage of the processing of mineral materials and of the manufacturing of heavy pieces, having big dimensions, mantles for granite rollers and rubber rollers in the paper and bakery industries is in an incipient stage, and knowledge about these fields have only the specialists and firms that produced effectively this type of pieces for particular situations and purposes.

The cutting and the grinding of the rubber products (mantles, rollers) presents some particularities of the cutting processes, different of the manufacturing (by cutting) processes of the metals. The machinability of the mineral and ceramic materials, as the machinability of the rubber materials is influenced by the structure of the processed material, by them hardness and by

them fragility. In the same time, it is influenced by the choice of the cutting regime. In the same time, the study of the cutting ability (named sometimes cutting capacity) of the newer or older tools at this kind of processes is almost non-existent in the specialty literature, fact that imposes serious researches in this sense. As new ulterior research directions we see new applications few broach and the extension of the researches for big pieces, as rubber mantles manufactured on hard machine-tools. In the same time the extension of the researches at a bigger number of non-conventional materials.

Acknowledgments. *The work has been funded by the Sectorial Operational Programme Human Resources Development 2007-2013 of Minister of European Funds through the Financial Agreement POSDRU 187/1.5/S/155420.*

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CONSIDERAŢII PRIVIND PRELUCRABILITATEA PRIN TĂIEREA MATERIALELOR MINERALE ŞI DIN CAUCIUC UTILIZATE CA MANTELELE LA ROLELE IN INDUSTRIA PRELUCRARII HARTIEI ŞI ÎN PANIFICAŢIE

(Rezumat)

Lucrarea de faţă îşi propune să prezinte stadiul actual al aprecierii tehnico-economice al prelucrărilor materialelor minerale şi a analizei capacităţii sculelor aşchietoare folosite la strunjirea şi rectificarea mantalelor ceramice şi a celor de cauciuc ale cilindrilor din industria hârtiei şi din morărit.

Rezultatele prezentate în acest articol au fost obţinute cu sprijinul Ministerului Fondurilor Europene prin Programul Operaţional Sectorial Dezvoltarea Resurselor Umane 2007-2013, Contract nr. POSDRU 187/1.5/S/155420.