Riskulov A.A., *DSc, Prof. of the Materials Science and Mechanical Engineering Department, Tashkent State Transport University*

Nurmetov Kh.I., *Senior Lecturer of the Materials Science and Mechanical Engineering Department, Tashkent State Transport University*

Abdurakhimov M.M., *assistent of the Materials Science and Mechanical Engineering Department, Tashkent State Transport University*

Rakhimov U.T., *assistent of the Materials Science and Mechanical Engineering Department, Tashkent State Transport University*

Urazbaev T.T., *assistent of the Materials Science and Mechanical Engineering Department, Tashkent State Transport University*

PREPRODUCTION FEATURES OF THE PARTS MANUFACTURING BY MATERIAL SELECTION

Abstract. Production of technical articles starts from selection of materials which they will be produced of a scientifically grounded approach to solving this problem lies in application of methods and means of the system approach. The system approach is a direction in methodology of scientific cognition which is based on consideration of objects as systems consisting of a multiplicity of interconnected elements which form integrity, a unity.

Keywords: Production of technical articles, material selection, operability of articles, effectiveness, production process, manufacturing technology, equipment stock.

The aim of the system approach to material selection is grounding of a selection strategy or forecasting results of selection of the most practicable materials. Complexity of this goal lies in the necessity of analysis of a large group of factors which determine relations between production and article consumers: nomenclature of materials, multiplicity of parameters of their structure and properties, levels of their hierarchy, saturation of connections between the levels, and interconnection between technological, economic, social, and other aspects.

Selection of materials for manufacturing of technological articles starts from material nomenclature analysis. Its aim is to find out materials possessing the best combination of operating parameters.

Further basing on technological properties of the selected materials variants of manufacturing technology of an article are considered depending on its construction, weight, dimensions, and the type of article surface processing etc. Materials of the optimal variant have to be accessible, to possess low cost, and to meet the criteria of economical effectiveness. This means that operability of articles produced of them has to correspond with social labour costs on realisation of their technological advantages taking into account the social effect of their use and the economic impact of production. Such a comparison is a serious problem due to narrow specialisation of sciences, particularly due to disconnection of technological and economic disciplines.

Article construction, materials used in it, and a technology of article obtainment are connected with the structure of production which turns out these articles. A technological basis for obtainment of articles which possess a set *use value*, i.e. usefulness, the property to meet a person's needs, social costs of production being the lowest. Social costs reflect a society development level and determine the effectiveness of elements of a production process: labour power and means and objects of labour i.e. materials. A scheme of material selection at the early preproduction stage is given in Figure 1.

An article manufacturing technology and equipment stock required to process materials into articles have to be determined during preproduction. Obtainment of an article which possesses a set use value, i.e. the possibility of an article to satisfy some human need, is the criterion of right selection of materials and technologies for their processing. A technology determines definite connections between a material and an article. Carrying out of each technological process leads to an increase in cost of materials being processed; therefore, a study

of ways for saving at the stage of technology designing determines effectiveness of future production to a significant extent.

Quality and material processing output are the main criteria for selection of an article obtainment technology. The latter factor has a substantial influence on article value formation and a decrease in material consumption standards. Consequently, the basics of resource-saving technologies are laid in cooperation of technologists and structural engineers.

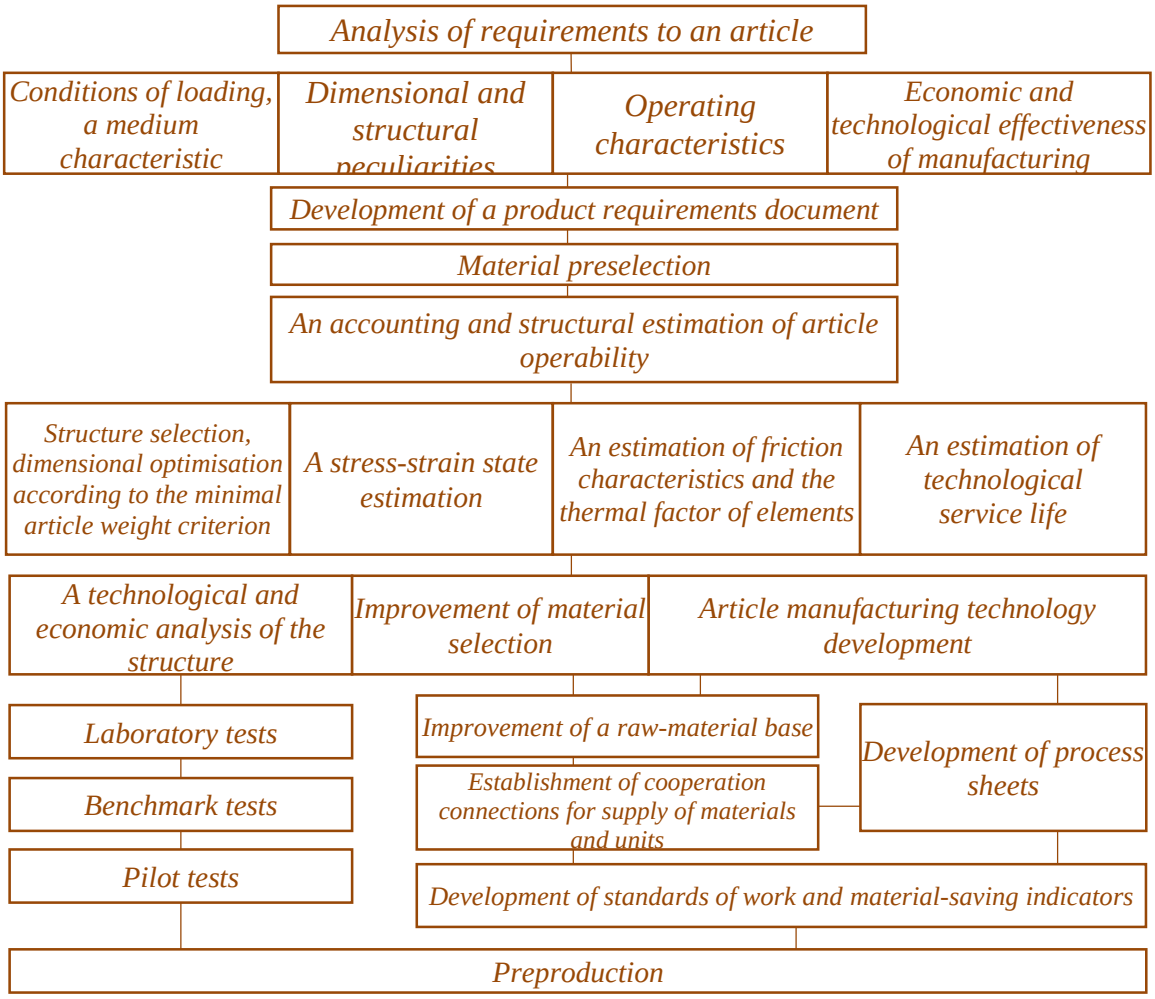

Figure 1. Scheme of material selection and requirements to a new material

Inter-industrial standardisation involving cooperation partners and technological and economic grounding of material consumption standards promotes a material loss decrease in the process of technological processing. This stage of preproduction ends with development of process sheets, documents which formalise the article manufacturing process and enlist the succession of

technological operations, the materials being processed, production and technological equipment, technological modes of operations and the time necessary for them, and personnel qualification etc.

Technological progress determines practicability of systematic adjustment of a material consumption structure through replacement of one material with another and also through relevant technological reengineering of production.

Stability of properties of materials in extreme operating conditions becomes more and more topical in relation to technology progress and exaggeration of working conditions for machines.

Purity of materials is in most cases a prerequisite to stability of their properties. Therefore, material purity requirements have soared. Until recently pure materials met the definitions “commercially pure” (basic component level is 99.9% or “chemically pure” (99.99%). Now atomic energetics needs super-pure uranium and thorium (e.g. boron impurity in uranium may not exceed 10–5%). Material purity requirements in semiconductor technology are even higher: impurity standard in most materials is not more than 10–11%. Quantum electronics (working parts of lasers) and space technology (solar batteries, fuel etc.) became super-pure material consumers. Many super-pure materials revealed unexpected properties. Thus easily corroding iron and zinc successfully resist corrosion when purified; chromium, titanium, tungsten, molybdenum, and other refractory metals considered hard and brittle become compliant after high purification and may be rolled into foil. The issue of material property stability is solved in technology in several directions among which the following are the most important ones. Protection of materials against chemical interaction with the environment, aggressiveness of which increased much due to the rise of manufacturing activity of human, has become topical. Expenses on material wear effect liquidation in machines have become colossal. Knowledge of ageing laws for materials, i.e. change of their structure and properties through time, is

necessary to take material property stabilisation actions and process item working ability forecast.

Comparison of the selected engineering and technological decisions is carried out through technological and economic analysis in the process of which correspondence of costs of article production to a level of its operating properties is estimated. The aim of such an analysis is to find out the best relation of article cost and its effectiveness and to create prerequisites for elimination of some cost constituents through it. In other words, one has to choose such solutions that cause carrying out of the basic function or a group of functions of an article with minimal expenditures of social labour involved. Such an approach allows directing not only at technological capabilities, but also at the criteria of social practicability of production as early as at the beginning stage of article engineering.

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