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THE SECURITY OF ABRASIVE FLOW MACHINING BY SELECTING COMPOUNDS SAFE WORKING MEDIUM

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Keywords: abrasive flow machining, work medium, abrasive grain.
Abstract. Considered the safety of the use of components used working medium for abrasive flow machining.

ОБЕСПЕЧЕНИЕ БЕЗОПАСНОСТИ АБРАЗИВНО-ЭКСТРУЗИОННОЙ ОБРАБОТКИ ПОСРЕДСТВОМ ВЫБОРА БЕЗОПАСНЫХ СОСТАВОВ РАБОЧИХ СРЕД

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Ключевые слова: абразивно-экструзионная обработка, рабочая среда, абразивное зерно.
Аннотация. Рассмотрена безопасность применения используемых компонентов рабочих сред для абразивно-экструзионной обработки.

Abrasive flow machining (AFM) is one of the most effective methods for processing hard-to-reach and complexly shaped surfaces of parts that meet the requirements for accuracy and surface quality. The essence of the method consists in extrusion along the surfaces of viscoelastic working medium (WM) filled with abrasive grains. Currently, the preparation and delivery of WM in the installation is not automated. Therefore, special attention should be paid to the safe preparation and use of WM when selecting its composition, or else the development of measures to protect the operating personnel is required. The working environment for AFM consists of a polymer base (silicone and other polymers are capable of large elastic deformations as they move in the channel being processed), working elements and components that change its properties (plasticizers and modifiers) [3]. Synthetic heat-resistant rubber (GOST 14680-74) (high molecular weight dimethylsiloxane, molecular weight 420-670) with the addition of fine fluoroplast-4, silicone liquid PES-5 and ground mica SMM-125 [1], silicone mastic SS-91 or plasticized rubber. This composition of WM has exceptional chemical inertness with respect to almost all aggressive medium, non-toxic.

Also proposed is the use of a silicone polymer with the addition of rubber particles of thermoplastic polymers — silicone, polystyrene, polyurethane, ethylene (hazard class 2), polyvinyl, polyamide, polypropylene, and polycaprolactan. In this composition, the danger is the toxicity of polyurethanes, due to the presence of diisocyanates in them, the specificity of the effects on the body depends on their chemical structure. Aliphatic diisocyanates exhibit mainly irritating effects on the skin and mucous membranes of the respiratory tract (sometimes with respiratory disorders) and eyes; aromatic have more pronounced allergenic properties (can cause eczema and asthma). It was also proposed to use clay of betonite (hazard class according to GOST 12.1007-76 - class 4 "Low hazard substances") with the addition of water and alkali KOH [2]. Potassium hydroxide (KOH) according to the

degree of exposure to the body belongs to the substances of the 2nd hazard class. Harmful by inhalation, in contact with skin and in eyes. Causes a chemical burn. Known WM-based guar gum with the addition of boric acid and borax, but its main drawback is the harmful effects on equipment and personnel. Guar gum contains toxic substances dioxin, which is an extremely hazardous substance, and pentachlorophenol, a moderately hazardous substance. Boric acid, like its derivative - borax enter the body through inhalation in the form of vapor or aerosol. Boric acid dissolved in water penetrates well through damaged skin (eczema, cracks, burns), causing poisoning of the human body. It has been proposed to use nitrolignin obtained by nitration of hydrolignin with the addition of 1 to 5% sodium nitrite (surfactant), kerosene, triethanolamine, sulfofresol, and potassium soap as the basis of WM [4]. Such a composition, on the one hand, solves the problem of utilization of waste from hydrolysis production, but on the other, especially in the case of an incomplete nitration reaction, is characterized by considerable chemical aggressiveness and requires additional protection costs. The main danger is the use of nitric acid for the preparation of WM, in which there is a risk of vapor poisoning and skin burns. Sodium nitrite (NaNO2), which is part of WM, is toxic, toxic, flammable, is an oxidizing agent, its interaction with combustible substances can be accompanied by an explosion. The hazard class according to the degree of impact on the human body is 1. Kerosene can be explosive fog affecting human skin, eyes and respiratory organs. Triethanolamine with prolonged use can cause severe dermatitis. Sulfofresol (a mixture of tar with spun distillate and an admixture of sulfur) increases the incidence of tumors of the digestive tract and skin. Potassium soap is dangerous if inhaled, in contact with skin and eyes. Dust is irritating and may cause chemical burns. Causes ulceration of the mucous membrane of the nose, with prolonged contact - thickening of the skin on the palms of the hands and soles of the feet, 3 class of danger. Isotropyl stearate (no indication of toxicity or hazard) and tetrafluoroethylene powder, a highly toxic substance of the 4th hazard class, especially in the gaseous state, were used as modifiers. All WMs containing components that are hazardous to human health must be prepared and used in strict compliance with safety regulations and the use of personal protective equipment.

From the analysis performed it can be seen that, at present, the selection of WM composition for AFM is mainly based on the requirements of economic feasibility and process performance. The safety of the cooking process and the use of the WM is poorly considered. It is the safety of WM for AFM that should be the basis for the choice of their compositions.

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