STUDYING THE INFLUENCE OF MAGNETIC AND ELETROMAGNETIC FIELD ON FLUIDS

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Abstract. This thesis is about analyzing of one of the most important problems in mechanical engineering. Cutting process has a huge impact on accuracy of machining detail and improving the condition of cutting process helps to increase the accuracy of machining detail. Authors studied the research works and papers which is related to effect of magnetic field on liquids. As a result of their literature analyzing, they found very essential dates about the effect of magnetic field on fluids.
Key words. Cutting process, electromagnetic field, lubricating cooling liquid, machining, magnetic field

1. Introduction

Manufacturing and mechanical engineering is being developed and increased in the Republic of Uzbekistan. There are about hundred machine-building plants, which are working in Uzbekistan. Tashkent metallurgical plant, which are provided with modern technics and technology, is planned to start working during next 2-3 years. Cutting processes has been started to use in machining factories very fast.

Cutting materials has its special point among many technological ways, especially, details, machines and equipment with exact sizes. Nowadays, demand for competitive exactitude is increasing. Universality of mechanical machining "Flexibility" increased it's advantage in many production such as standard production, serial production etc. it is possible to reach high accuracy by cutting job. Quality of the machined surface also would be higher. Moreover, cutting is cheaper than other methods: Energy consumption, preparation time of the plant for manufacture are also low. For example, it is cheaper than casting and working with pressure.

2. Methods and materials

This problem is much complicated and serious. The most Famous and talented scientists of the world who worked and are working on the sphere of cutting metals were introduced following basic specialties for developing the subject of cutting:

- Quickening the process of cutting- "intensification"
- Mastering working with new modern materials
- Atomizing and mechanizationing of the process
- Increasing quality and accuracy of working
- Rising scientific degree of explorations

Mechanical working is different with it's high effectiveness, "Flexibility", opportunity of machining difficult surfaces and forms, high surface quality, machining new materials (composite materials).

It is important to add high working effectiveness, Least energy consumption, technological machinability, reliability and universality.

Controlling the effect of lubricating cooling liquid for intensification on the process of cutting is being important during the last years.

One of the tendencies of developing machine building is application of new technological processes. Especially, by using the achievements of two or more subjects. Nowadays, magnets, Thermomagnets, thermoelectrical conditions are being widely utilized for increasing working effectiveness, decreasing the cost of the product, creating new competitive product.

Gaponova O.P. and Troitskiy A.N. [15] has studied the effect of heat treatment on fast-cutting steels hardness under magnetic field. They emphasized that cutting properties of fast-cutting steel can be provided by alloying with high carbides, such as W, Mo, B and Co which doesn't make carbide. If P18, P12 high wolfram fast-cutting steels are changed by more cheaper P6M5 steel, physical mechanical properties of P6M5 are increased by heat treatment using the method of progressive way.

To their point of view, changes of steels and structural changes of steels are because of heat treatment. Heat treatment was carried out in two ways: 1 – temperature of details was increased until it reached treatment temperature under the magnetic field. 2 – Detail was treated under electromagnetic field. Steel P18 has been chosen for experiment and electromagnetic end solenoid oil were settled in container. In the variable magnetic field, Hardness of tempering and hitting viscosity increased and extracting of rest austenite

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hastened. Process of independent tempering is emerged by the effect of magnetic field. That condition is increased if carbon which is in the structure of steel increases. Structure is more in magnetic field(it is dispersed). In high carbonic steels(>0,6%), because of self-tempering in austenite – martensitic adjusting, decreasing of rest austenite and increasing of martensitecan be seen. As a result of this, characteristics of solidity and plasticity is increased.

Numerous papers reported that the magnetic field could change the physicochemical properties of water since several decades [1–9]. When water passing through a magnetic field, it become magnetized water. Han et al. investigated the optical properties of water that between two strong magnets, they found that the infrared absorption property of magnetized water changed [2]. Holysz et al. concluded MF could enhance the conductivity and decrease the surface tension of water [3,4]. Wang et al. has examined the effect of a static magnetic field on liquid water using frictional experiments, the results suggested the friction coefficient was smaller in the magnetic field [5]. Cai et al. studied the effect of magnetic field on the hydrogen bonds of water, and discussed the mechanism of magnetization based on molecular dynamics simulation, experimental and theoretical models [6–8]

E.A. Umarov and F.Y. Yakubov [16,17] defined that magnetic field do not always impact on firmness of cutting tool and thermal electrical coefficient of thermal pair similarly. It depends on cutting condition

S.M. Xasanov [18] concluded in his work that technological condition, influence on generation process of oxide layers and existence of magnetic field.

V.E. Nikolskiy [19] analytically and experimentally investigated the influence of magnetic and electric fields with tension gradient in the direction of the movement of the contacting gas-liquid phases. The choice of the most effective method of impact on a heat mass exchange process for the purpose of increase in energy efficiency of submersible burning devices are executed. They offered the control method of fluctuations in the contacting phases of gas-liquid with the use of measuring transducer with the cylindrical resonator.

F.L. Rashid and his colleague [14] presented an investigation of water evaporation through magnetic field of 0.5 T, which was located at different location of tested water height (water-air interface, water mid height and bottom). An increase in evaporation time led to increase the evaporation rate, the preferred location of magnetic field is at the water-air interface which gave more evaporation rate (6% more than absence magnetic field) compared with other location, there is no effect was seen in the case of putting magnetic field at the bottom of water height

Water treatment by magnetic field or physical water treatment is an attractive but still controversial issue. M. Amiri and A.A. Dadkhah [13] investigated whether or not a physical water treatment reduces the surface tension of water as reported in some scientific literature. In their work, physical water treatment phenomenon was studied by measuring surface tension of treated and untreated waters. More than 200 tests were done during a six-month period in various conditions to evaluate the validity of the observed phenomenon. The test results showed that surface tension of water is too sensitive to experimental conditions to be considered as a safe and reliable indicator for studying the effects of magnetic field on water. It was found that meaningful changes in surface tension of a liquid sample after a day can be a good indicator for presence of physical or chemical changes in the sample.

It was found that the surface tensions of both tap and pure waters depend on frequency of magnetic treatment. Fig. 1 shows the effect of number of magnetic treatment (frequency) on surface tension of pure water. MF treatment of tap water also resulted in the similar trend of reduction in surface tension.

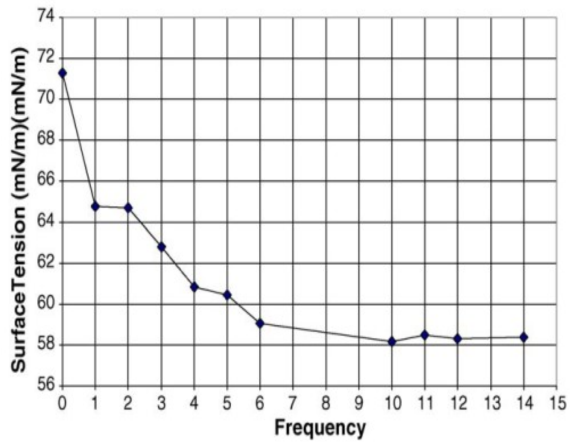

Fig.1. Dependence of affecting frequency of magnetic field on surface tension of pure water

V.N. Tritigin at.al [12] studied the influence on microflora of water-oiled lubricant cooling liquid of a weak electromagnetic pulse field. The hypothesis of action of an electromagnetic pulse field of extremely low-frequency range on a microflora is presented.

In use, the emulsion lubricoolant becomes soiled microorganisms. Lubricoolant is characteristic signs of microbiological defeat hydrogen sulfide selection (the second hazard class) and other accompanying gases possessing an unpleasant smell. Lubricoolant with a steady unpleasant smell even at high technical characteristics, it is unsuitable for application and it has to be replaced. Smell of lubriccolant is one of the controlled indicators, determined by a special technique organoleptic and it is directly connected with concentration in it's bacterial flora characterized by it's general microbus number. So far for decrease in concentration of microorganisms bio additives are entered into lubricoolant.

Strength of pulse magnetic field in the coil of the solenoid was determined by the oscillogram of an oscillograph of C1-117 type by an estimated way. As a result of the conducted researches it was set (fig. 3)

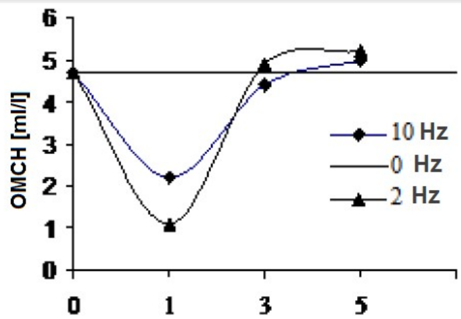

Fig. 3. Impulse torsion of magnetic field in the coil of solenoid

I.M. Ageev has noted that one of the hypotheses explaining effect of weak magnetic field on biological objects is change of water properties which is their part. Thus, the problem is transferred from area of an electromagnetically biologically to the field of physics of water

Unlike researches of influence of weak magnetic fields on biological objects of work on a research of changing physical properties of water under the influence of magnetic field are rather not numerous. In their works, it was reported about change of light scattering of water and water solutions. It turned out that the value of light scattering is subject to quasiperiodic fluctuations. The range of a scattered light depends by nature-dissolved substance and changes at influence of constants and alternating magnetic fields. These experiments were repeated and authors found light scattering variations with some set of the periods. In the work, measurements of index of refraction, conductivity, acidity, a heat transfer, depth of overcooling, a tangent of dielectric losses of the bidistilled water and ice were taken.

S.M. Hassan and R.A. Rahmon’s study [10] is a step towards gaining a better understanding of the effect of magnetism on water properties and on the biology of culture organisms, such as the brine shrimp, A. salina. Their study evaluates the effects of magnetic field exposure on water properties, which in turn affect the hatchability of A. salina. Water was passed through three magnetic devices of different intensities, i.e. 0.1, 0.15 and 0.2 Tesla, respectively, once at every 5 hour interval. The dissolved oxygen (mg/L) was found to increase (from 3.84 mg/L to 4.51 mg/L). pH also increased from 7.11 to 7.42 which is favorable for A. Salina. The ammonium (NH4-N mg/L) and ammonia (NH3-N mg/L) levels decreased from 0.43 mg/L to 0.28 mg/L and from 0.36 mg/L to 0.19 mg/L respectively. Salinity (ppt), specific conductance (μS/cm) and total dissolved solids (mg/L) were also found to have increased significantly ($P \le 0.05$) after magnetization. Overall, the exposure of water to a magnetic field was found to have increased the hatchability rate of A. Salina significantly ($P \le 0.05$). A much better increase of 39.61% (41.67 to 69.00) in A. Salina hatchability rate (H%) was attained in water exposed to a magnetic field of 0.15 Tesla for four times. This has positive implications for aquaculture because a higher rate of A. Salina hatchability means that the brine shrimp can be produced more economically and a good sign for application of magnetic water for other aquaculture.

H.Banejad and E. Abdosalehi [11] has examined magnetic field intensities of zero Tesla (as a witness), 0.05 Tesla, 0.075Tesla, and 0.1 Tesla. In addition, they has chosen amounts of water influent 4lit/h and 30lit/h. With doing examination by 3 times and analyze the results with SAS software, have shown that changing magnetic field intensity, amounts of water influent, and also together influence there factors, have significant effects at level of 99 percent on reducing of water hardness. In the other way, for finding their mechanisms, analyzes done by X ray. Calcium carbonate exists in two forms, calcite and aragonite. But the main form of sediment is calcite. Results showed that amount of aragonite in compare with calcite, by attention to situation, increased 70 percent to 99.99 percent and ratio between calcite/aragonite had a main reducing.

3. Consolation

According to informations above, effect of magneticfield on the process of cuttingisnoticeable. It isclearthatdurability of cuttingtoolcanbeimproved and controlled by using the methods of increasingitsstabilityundermagneticfield.

One of the most important thingisthatitcanbe possible to control effectiveness of heattreatment of toolmaterial. It isobviousthatworkeffectivenesscanbeimproved by increasing wear resistance of cuttingtool by usinglubricoolant.

According to literatureanalysis, magneticfield impact on the properties of lubricating condition sufficiently.

On the other hand, impact of lubricatingliquid on cutting condition depends on itsproperties. It isshownabovethatmagneticfieldstrongly affect the physical-chemicalproperties of lubricoolant.

It isclearfromliteratureanalysisabovethateffect of lubricatingcooling condition of whichphysical-chemicalproperties are changed by magneticfield.

It isalsoobviousthateffect of magneticfield on liquidsdepends on theirmagnetizing condition. As conclusion, changingpropertiesabove and controllingtheir impact on cuttingprocess has a hugescientific and practical importance.

References

[1] Pang XF, Deng B. The changes of macroscopic features and microscopic structures of water under influence of magnetic field. Phys B Condensed Matter 2008;403(19–20):3571–7. https://doi.org/10.1016/j.physb.2008.05.032.
[2] Han X, Peng Y, Ma Z. Effect of magnetic field on optical features of water and KCl solutions. Optik-Int J Light Electron Optics 2016;127(16):6371–6. https:// doi.org/10.1016/j.ijleo.2016.04.096.

[3] Holysz L, Szczes A, Chibowski E. Effects of a static magnetic field on water and electrolyte solutions. J Colloid Interface Sci 2007;316(2):996. https://doi.org/10.1016/j.jcis.2007.08.026.
[4] Amiri MC, Dadkhah AA. On reduction in the surface tension of water due to magnetic treatment. Colloids Surf A 2006;278(1):252–5. https://doi.org/10.1016/j.colsurfa.2005.12.046.
[5] Wang Y, Zhang B, Gong Z, et al. The effect of a static magnetic field on the hydrogen bonding in water using frictional experiments. J MolStruct 2013;1052(11):102–4. https://doi.org/10.1016/j.molstruc.2013.08.021.
[6] Cai R, Yang H, He J, et al. The effects of magnetic fields on water molecular hydrogen bonds. J MolStruct2009;938(1–3):15–9. https://doi.org/10.1016/j.molstruc.2009.08.037.
[7] Toledo EJL, Ramalho TC, Magriotis ZM. Influence of magnetic field on physical– chemical properties of the liquid water: insights from experimental and theoretical models. J MolStruct 2008;888(1–3):409–15. https://doi.org/ 10.1016/j.molstruc.2008.01.010.
[8] Chang KT, Weng CI. The effect of an external magnetic field on the structure of liquid water using molecular dynamics simulation. J ApplPhys 2006;100:043917. https://doi.org/10.1063/1.2335971.
[9] Liu B, Gao B, Xu X, et al. The combined use of magnetic field and iron-based complex in advanced treatment of pulp and paper wastewater. ChemEng J 2011;178(1):232–8. https://doi.org/10.1016/j.cej.2011.10.058.
[10] S M Hassan and Ridzwan Abdul Rahman, "EFFECTS OF EXPOSURE TO MAGNETIC FIELD ON WATER PROPERTIES AND HATCHABILITY OF Artemia Salina" 11, no. 11 (2016): 416–23, www.arpnjournals.com.
[11] H Banejad and E Abdosalehi, "Theё Effect of Magnetic Field on Water Hardness Reducing," … Water Technology Conference, IWTC, no. May (2009): 117–28,http://www.fluxindia.com/images/maxguard_certificates/reference/theeffect.pdf.
[12] И Г Шайхиев et al., "Удк 66.086.4," n.d.,"Влияние Электромагнитного импульсного поля на микрофлору смазочно-охлаждающей жидкости," n.d.
[13] M. C. Amiri and Ali A. Dadkhah, "On Reduction in the Surface Tension of Water Due to Magnetic Treatment," *Colloids and Surfaces A: Physicochemical and Engineering Aspects* 278, no. 1–3 (2006): 252–55, https://doi.org/10.1016/j.colsurfa.2005.12.046.
[14] FL Rashid and NM Hassan, "Increasing Water Evaporation Rate by Magnetic Field," *International Science and Investigation Journal* 2, no. September (2013): 61–68, http://isijournal.info/journals/index.php/ISIJ/article/view/12.
[15] Гапарова О.П., Триоцкий А.Н. "Влияниетермическойобработки в магнитномполенатвердостбыстрорежущихсталей".
[16] Умаров Э.О., "Исследованиетермоэлектрическихявленийприрезаниеметаллов". Кандидатскаядиссертация, ТашПИ, Т. 1966г.
[17] Якубов Ф.Я., "Исследованияпричиннемонотонногоизмененияызависимости "Скорост-резания-стойкостьрежушегоинструмента"" Кандидатскаядиссертация, ТашПИ, Т. 1966г.
[18] Хасанов С.М., "Повышениепроизводительностимеханическойобработкипосредсвоммагнитноговоздействиянарежушиеинструментыизбыстрорежушихсталей". Кандидатскаядиссертация, Т. 1987г
[19] В.Е. Никольский и другие. "применениеэлектромагнитныхполейдляинтенсификацииитепломассообмена в совмещенныхгазожидкостныхпроцессах". Восточно-Европейскийжурналпередовыхтехнологий: 1729-3774. 3/8 (87) 2017