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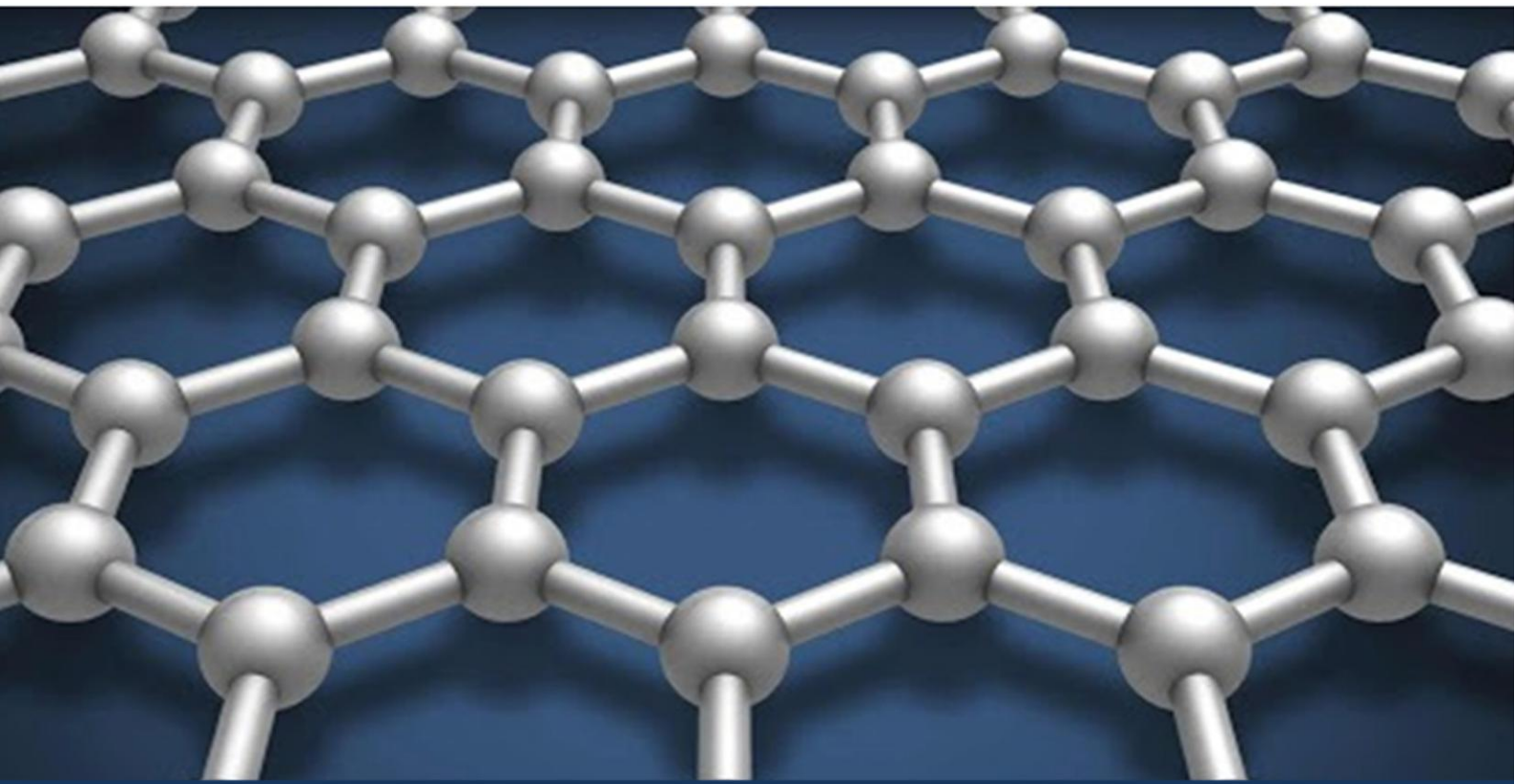

Узбекский научно-технический и производственный журнал

Композиционные материалы

Кальций цианамид олишнинг кинетик тадқиқотлари орқали уни аммиакка (0,7125) ва углерод диоксидга (0,416) нисбатан кимёвий реакция тартиби ўрганилди. Реакция тартибидан шу нарса маълум бўлдики, бундаги реакциянинг стехиометрик тенгламалари оддий эмаслиги ва жараён механизми ўта мураккаб тузилганлигидан далолат беради. Тадқиқот натижалари шуни кўрсатдики, кальций цианамидни ҳосил бўлиши дастлабки даврда катта тезлик билан амалга ошди кейинчалик эса вақт узайиши билан маҳсулот чиқишида мувозанат сақланди реакция тезлиги эса камайди.

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THE ROLE OF ALLOYING ELEMENTS IN IMPROVING THE MECHANICAL PROPERTIES OF ALUMINUM-MAGNESIUM ALLOYS: AN OVERVIEW AND AN ECOLOGICAL ANALYSIS

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Annotation: The results of the literature analysis revealed that the global warming potential of scandium is more severe than the other two elements. The rarity of this metal makes the process more energy-intensive and as a result, more dangerous to the environment. As for the other two elements, zinc was considered as the least harmful alloying element and the second more environmentally-friendly element is silicon. The carbon emissions emitted to the environment of silicon and zinc are 3.8 and around 4.8kg per kg of the elements produced respectively, while this figure for scandium is equal to 1135 kg.

Key words: environmental issues, global warming potential, scandium, silicon, zinc, aluminum alloys, aluminum, alloying elements, carbon emissions.

Introduction. Today, the terms aluminum and aluminum alloys can be found everywhere, ranging from engineering constructions to medicine. While engineering industry focuses on the mechanical properties, structure, and other related properties, the focus of medicine is directed to the biological characteristics and the interaction medical instruments with the human body. Google Scholar shows that a search on aluminum alloys can find almost 3 million articles and patents [1], while in the scopus database this number is 325,590 [2]. These figures indicate the relevance of alloys and the importance of their use in various industries. Not only do these alloys have relatively better properties such as low density, good corrosion resistance, high strength and others, but also their recyclability occupies another place in the environmentally friendly industry. When considering improving properties, environmental issues related to the production and use of these alloys or elements should also be taken into account. So, this review article provides a good introduction to the study of alloying aluminum alloys with three different alloying elements and analyzes the environmental consequences of alloying aluminum alloys with these elements. To better understand the effect of the three different additives, the analyses were performed using Al-Mg alloys as the base.

The role of scandium in improving the physico-chemical properties of aluminum-magnesium alloys.

Scandium has advantages in aluminum alloys due to the fact that even a small addition of it to the composition can significantly change the properties of the alloy such as hardness, tensile strength, ductility, grain boundary changes, etc. [3-5]. Scientists of National–Local Joint Research Center and University of Technology in China presented remarkable and distinctive results of alloying Al-Mg alloys with Sc. The study showed that adding scandium to the alloys potentially improves the mechanical strength and grain refinement. For the analysis, the researchers used four experimental alloys with different Sc contents (0%, 0.2%, 0.4% and 0.6%). Meanwhile, the equipment included optical microscope for micrographic studies, a Raytek infrared thermometer for measuring cooling rates and an HBV-30A Micro-hardness tester (10kg for 30s), as well as other property testing for analyzing the mechanical behaviors. Optimal mechanical properties and microstructure were obtained by adding Sc in a percentage of 0.4%, when an increase to 0.6% caused some problems with properties. Despite the increase in hardness and strength, the addition of the element (Sc) greatly affected the ductility of the Al-Mg alloy [6].

Ecological aspects of alloying Al-Mg alloys with Sc, Zn and Si.

Green energy has become the most crucial element in every industry globally. Cradle to grave or cradle to cradle formulas have been becoming an important aspect to take into account. The assessment of the life cycle of each product and tool is no less important than an analysis showing the advancements of developing technologies and industries. Although some elements may have different effects, it is generally recommended to choose those that have a less serious impact on the environment. The table below shows the impact of each element's production, with a focus on global warming potential from their production and use. As can be seen from the table, the global warming potential is significant in scandium production, whereas while emissions of the other two elements into the environment are less harmful. Excessive carbon emissions can be caused by the rarity of this element and the high energy consumption. However, it should also be noted that scandium dioxide (Sc_2O_3) may have a lower impact on the environment (743kg of CO_2 emissions) than pure scandium (1135kg of CO_2). In the production of silicon and zinc, carbon emissions are lower (4.8kg and 3.8kg respectively) than in the production of scandium. While aluminum production alone leads to emissions of 10.04 kg per kilogram of aluminum produced zinc production can be relatively more environmentally friendly than scandium and silicon production.

Conclusion. The study aimed to provide an overview on the impact of the additions of three different alloying elements and their environmental impacts. The results of the analysis can be drawn as follows:

1. According to the analyzed studies, 0.25% of scandium leads to the improvement in hardness, strength and the ductility of the in the alloy.
2. 4.62% of zinc provided an opportunity to improve yield strength, tensile strength, while 2% of Zn addition leads to the increased density and viscosity.
3. 4.4% of silicon led to the improved tensile strength, and a decreased elongation, but the higher ratio Mg/Si led to the better performance in electrical conductivity and strength.

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3. Разработка и технология получения композиционных материалов

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