

**EFFECTIVENESS OF USING ELEMENTS OF NANOTECHNOLOGY IN CONSTRUCTION MATERIALS SCIENCE**

Bakhodir Rizayev<sup>1</sup>, Islombek Akhmedov<sup>1</sup>, Shavkat Yusupov<sup>1</sup>, Isroiljon Umarov<sup>1</sup>, Aleksandir Kazadayev<sup>1</sup>, Farrukh Dadakhanov<sup>1</sup>

<sup>1</sup>Namangan Engineering-Construction Institute, Islom Karimov Avenue, 12, Namangan, Uzbekistan, 160103

**Abstract**

Nanotechnology is an applied science that deals with the creation of fundamentally new instruments and materials at extremely small sizes, and studies the properties of various substances at the atomic and molecular level.

When we talk about the essence of nanotechnology, nanotechnology is considered such a sensitive technology that it provides opportunities to control the process of obtaining materials at the atomic-molecular level, that is, with the help of atomic-molecular interaction. This can be the basis for talking about "directed" material science, including construction material science.

For a builder-technologist who has mastered the basics of chemical technology, mastering the methods of nanotechnology does not pose a great difficulty. Obtaining nanosystems and nanoobjects can be done in several ways. One of these methods is to carry out this or that process by controlling atomic-molecular processes in order to obtain the components of the system not only on the scale of nanoparticles, but also in a given combination in terms of size and number.

Scientific results in the field of physico-chemistry, colloid chemistry, knowledge in the field of highly dispersed systems and films, surprising effectiveness of surface-active substances, mechanical-chemical activation of solid particles and water provide opportunities to achieve properties that seemed incredible before.

Among the promising nanotechnologies considered suitable for the production of construction materials, the following are the most interesting:

- Water activation (structuring);
- Grinding of primary materials and raw materials;
- Preparation of nanodisperse reinforcement.

Water activation (structuring). According to experimental studies, activated water has a significant effect on the properties of building materials. The structure of water and its properties are determined by the interaction and shape of "clusters". Clusters are groups of atoms. According to the size of atoms (-0.3 nm) and clusters of water (several nm), the production and use of structured water can be said to belong to the family of nanotechnologies. To date, methods and tools have been created to change the physicochemical properties of water and other liquids in a non-aggregating (non-chemical) way (Fig. 1).

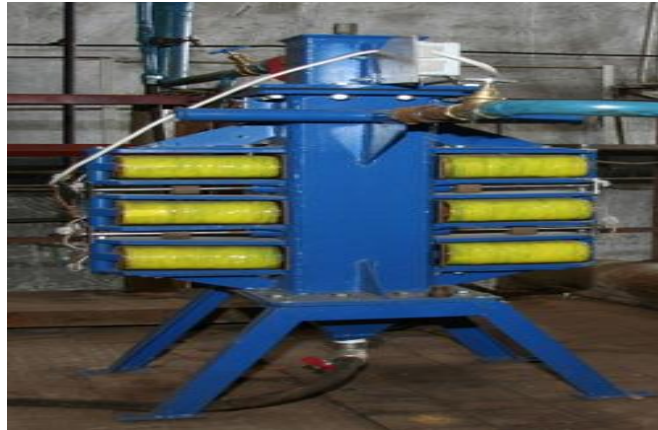


Figure 1. Activated water intake apparatus

The results of studies on the effect of activated water on the strength of concrete indicate that the strength can be increased by 20-30% compared to concrete prepared in non-activated water. In addition, the use of activated water leads to a significant reduction in the time it takes for concrete to reach its release strength. This creates ample opportunities to shorten construction periods, reduce energy consumption, and lower construction costs, especially for single-unit housing construction.

Innovations in this direction ensure the reduction of the mass of the houses under construction and the amount of loads falling on the foundations by 10-20%, and the cost of construction by approximately the same amount. Currently, scientific research on water activation continues. Grinding of primary materials and raw materials. Grinding of starting materials is carried out in rotor-pulsating apparatuses (RPA) (Fig. 2) and ensures dispersion of processed materials with significantly less energy consumption.

Increasing the dispersion of starting materials in RPAs is carried out up to 8000 cm<sup>2</sup>/g and more. As a result, the efficiency of modern technologies increases dramatically, energy consumption is significantly reduced, technological and physico-chemical properties of materials are improved.



Figure 2. Rotor-pulsating device

For example, short-term processing of cement suspension in RPA for mixtures, concrete and other cementitious compositions, while maintaining the high plasticity of the concrete mixture, shortens the period of hardening of concrete in natural conditions by 3 times, reduces the duration of heat treatment of products by 30...35%, cement consumption It provides a reduction



of up to 25% or a significant increase in concrete strength. The use of RPAs in the preparation of clay suspension increases the physico-mechanical properties of ceramic bricks or tiles by 1.5-2.0 times, reduces their cost and provides opportunities to save time and resources during the technological cycle.

Preparation of nanodispersed reinforcement. Reinforcement of concrete products and constructions has passed the way from separate rods, wires, flat and spatial frames, non-metallic composite reinforcement, to dispersed reinforcement in the form of fibers. A new step in the reinforcement of binder-based materials is the use of nanodisperse reinforcement. Natural minerals: gallausite, chrysotile-asbestos, and artificial carbon nanotubes can be used as nanodispersed reinforcement.

Gallausite is one such nanodispersed natural mineral. It is a clay layered silicate with a unique tube-like texture. According to the Mohs scale, its hardness is 1...2, and its density is 2...2.6 g/cm<sup>3</sup>. Gallausite is currently a raw material for the ceramic production industry. Another natural mineral, chrysotile-asbestos, is used as a nanodisperse reinforcement. Chrysotile-asbestos is a thin fibrous mineral belonging to the class of silicates, which forms aggregates of very thin flexible fibers. According to the Mohs scale, its hardness is 2...2.5, and its density is 2.5 g/cm<sup>3</sup>. Currently, chrysotile-asbestos is the main raw material for the production of asbestos-cement materials.

As for artificial carbon nanotubes (Fig. 3), they were discovered in Japan in 1991. Their tensile strength is almost 100 times greater than that of steel, and their dimensions are 50,000 times thinner than a human hair. Such pipes are also resistant to corrosion. The use of nanotubes as nanofibers dramatically increases the strength of concrete. For example, adding artificial carbon nanotubes (diameter 40...60 nm, density 0.086 g/cm<sup>3</sup>) at 0.05% to the cement mixture increases the strength of concrete made from them by 1.7 times, and reduces thermal conductivity by 20%. , at the same time, the average density of concrete decreases and the size of its pores stabilizes. Carbon nanotubes are produced in Japan and other countries. Japanese companies produce carbon nanotubes using the latest method - chemical deposition from a gaseous medium (from 140 to 250 g per hour) and use this product for commercial purposes.

Carbon nanotubes are cylindrical sheets made of carbon atoms. Since carbon nanotubes have very high physical properties, they are increasingly used, including in obtaining composite materials for various purposes.

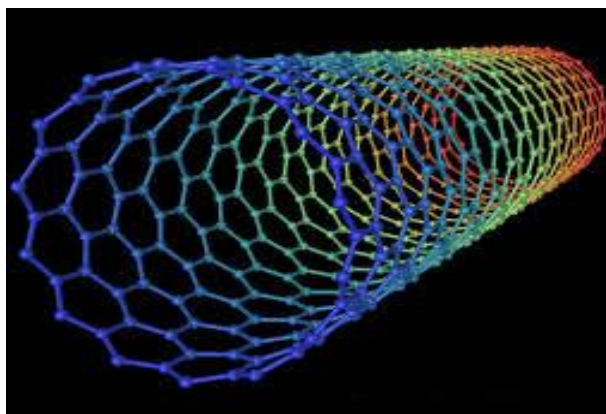


Figure 3. Carbon nanotubes

**REFERENCES**

1. Akhmedov, I., Khamidov, A., Shavkat, Y., Jalalov, Z., Umarov, I., & Kazadayev, A. (2022). RESEARCH OF ASH-SLAG MIXTURES FOR PRODUCTION OF CONSTRUCTION MATERIALS. *Spectrum Journal of Innovation, Reforms and Development*, 10, 85-91.
2. Akhmedov, I., Khamidov, A., Shavkat, Y., Umarov, I., & Kazadayev, A. (2022). DISTRIBUTION OF SEDIMENTS IN THE MOUNTAIN RIVER BED. *Spectrum Journal of Innovation, Reforms and Development*, 10, 101-106.
3. Khamidov, A., Akhmedov, I., Shavkat, Y., Jalalov, Z., Umarov, I., Xakimov, S., & Aleksandr, K. (2022). APPLICATION OF HEAT-INSULATING COMPOSITE GYPSUM FOR ENERGY-EFFICIENT CONSTRUCTION. *Spectrum Journal of Innovation, Reforms and Development*, 10, 77-84.
4. Akhmedov, I., Khamidov, A., Kholmirezayev, S., Umarov, I., Dedakhanov, F., & Hakimov, S. (2022). ASSESSMENT OF THE EFFECT OF SEDIBLES FROM SOKH SOY RIVER TO KOKAND HYDROELECTRIC STATION. *Science and innovation*, 1(A8), 1086-1092.
5. Kholmirezayev, S., Akhmedov, I., Khamidov, A., Umarov, I., Dedakhanov, F., & Hakimov, S. (2022). USE OF SULFUR CONCRETE IN REINFORCED CONCRETE STRUCTURES. *Science and innovation*, 1(A8), 985-990.
6. Kholmirezayev, S., Akhmedov, I., Yusupov, S., Umarov, I., Akhmedov, A., & Kazadayev, A. (2022). THE ROLE OF INTEGRATION OF SCIENCE, EDUCATION AND DEVELOPMENT IN STAFF PREPARATION FOR CONSTRUCTION. *Science and innovation*, 1(B8), 2237-2241.
7. Akhmedov, I., Khamidov, A., Kholmirezayev, S., Yusupov, S., & Umarov, I. (2022). IMPROVING RIVER SEDIMENT DISTRIBUTION CALCULATION IN MOUNTAIN RIVERS. *Science and innovation*, 1(A8), 1014-1019.
8. Kholmirezayev, S., Akhmedov, I., Khamidov, A., Akhmedov, A., Dedakhanov, F., & Muydinova, N. (2022). CALCULATION OF REINFORCED CONCRETE STRUCTURES OF BUILDINGS BASED ON THE THEORY OF RELIABILITY. *Science and innovation*, 1(A8), 1027-1032.
9. Kholmirezayev, S., Akhmedov, I., Khamidov, A., Yusupov, S., Umarov, I., & Hakimov, S. (2022). ANALYSIS OF THE EFFECT OF DRY HOT CLIMATE ON THE WORK OF REINFORCED CONCRETE ELEMENTS. *Science and innovation*, 1(A8), 1033-1039.
10. Kholmirezayev, S., Akhmedov, I., Khamidov, A., Jalalov, Z., Yusupov, S., & Umarov, I. (2022). THE ROLE OF THE INTEGRATION OF SCIENCE, EDUCATION AND PRODUCTION IN THE TRAINING OF PERSONNEL FOR CONSTRUCTION EDUCATIONAL AREAS. *Science and innovation*, 1(A8), 1040-1045.
11. Khamidov, A., Akhmedov, I., Kholmirezayev, S., Jalalov, Z., Yusupov, S., & Umarov, I. (2022). EFFECTIVENESS OF MODERN METHODS OF TESTING BUILDING STRUCTURES. *Science and innovation*, 1(A8), 1046-1051.
12. Kholmirezayev, S., Akhmedov, I., Khamidov, A., Umarov, I., Axmedov, A., & Abdunazarov, A. (2022). PROSPECTS FOR THE DEVELOPMENT OF REINFORCED



- CONCRETE STRUCTURES IN UZBEKISTAN. *Science and innovation*, 1(A8), 1052-1057.
13. Xamidov, A., Kholmirezayev, S., Rizayev, B., Umarov, I., Dadaxanov, F., & Muhtoraliyeva, M. (2022). THE EFFECTIVENESS OF THE USE OF MONOLITHIC REINFORCED CONCRETE IN THE CONSTRUCTION OF RESIDENTIAL BUILDINGS. *Science and innovation*, 1(A8), 991-996.
  14. Kholmirezayev, S., Akhmedov, I., Khamidov, A., Jalalov, Z., Yusupov, S., & Akhmedov, A. (2022). THE USE OF MONOLITHIC REINFORCED CONCRETE STRUCTURES ON THE TERRITORY OF THE REPUBLIC OF UZBEKISTAN. *Science and innovation*, 1(A8), 997-1003.
  15. Kholmirezayev, S., Akhmedov, I., Khamidov, A., Umarov, I., Dedakhanov, F., & Kazadayev, A. (2022). ANALYSIS OF METHODS FOR PROCESSING SERA RAW MATERIALS AND MAKING SEROBETON. *Science and innovation*, 1(A8), 1004-1008.
  16. Kholmirezayev, S., Akhmedov, I., Rizayev, B., Akhmedov, A., Dedakhanov, F., & Khakimov, S. (2022). RESEARCH OF THE PHYSICAL AND MECHANICAL PROPERTIES OF MODIFIED SEROBETON. *Science and innovation*, 1(A8), 1009-1013.
  17. Khamidov, A., Akhmedov, I., Kholmirezayev, S., Qodirova, F., Nomonova, S., & Kazadayev, A. (2022). RESEARCH OF ASH-SLAG MIXTURES FOR THE PRODUCTION OF BUILDING MATERIALS. *Science and innovation*, 1(A8), 1020-1026.
  18. Adhamjon, K., Islombek, A., Sattor, K., Shavkat, Y., Aleksandir, K., & Begyor, S. (2022). APPLICATION OF HEAT-INSULATING COMPOSITE GYPSUM FOR ENERGY EFFICIENT CONSTRUCTIO. *Science and Innovation*, 1(8), 1058-1064.
  19. Khamidov, A., Akhmedov, I., Kholmirezayev, S., Qodirova, F., Nomonova, S., Sharopov, B., & Kazadayev, A. (2022). INVESTIGATION OF THE PROPERTIES OF CONCRETE BASED ON NON-FIRING ALKALINE BINDERS. *Science and innovation*, 1(A8), 1065-1073.
  20. Khamidov, A., Akhmedov, I., Rizayev, B., Kholmirezayev, S., Jalalov, Z., Kazadayev, A., & Sharopov, B. (2022). THERMAL INSULATION MATERIALS BASED ON GYPSUM AND AGRICULTURAL WASTE. *Science and innovation*, 1(A8), 1074-1080.
  21. Khamidov, A., Akhmedov, I., Kholmirezayev, S., Qodirova, F., Nomonova, S., Sharopov, B., & Kazadayev, A. (2022). INVESTIGATION OF THE PROPERTIES OF CONCRETE BASED ON NON-FIRING ALKALINE BINDERS. *Science and innovation*, 1(A8), 1065-1073.
  22. Абдуназаров, А., Хакимов, С., Умаров, И., Мухторалиева, М., Дедаханов, Ф., & Шаропов, Б. (2022). МЕРОПРИЯТИЯ ПО ПОВЫШЕНИЮ ЭНЕРГОЭФФЕКТИВНОСТИ СОВРЕМЕННЫХ И РЕКОНСТРУИРУЕМЫХ ЗДАНИЙ. *Journal of new century innovations*, 18(1), 130-134.
  23. Hakimov, S., Sharopov, B., Umarov, I., Muxtoraliyeva, M., Dadaxanov, F., & Abdunazarov, A. (2022). URILISH MATERIALLARI SANOATIDA INNOVATSION

- MATERIALLAR ISHLAB CHIQRISHNING ISTIQBOLLI TOMONLARI. *Journal of new century innovations*, 18(1), 149-156.
24. Sharopov, B., Hakimov, S., Umarov, I., Muxtoraliev, M., Dadaxanov, F., & Abdunazarov, A. (2022). QUYOSH ENERGIYASIDAN FOYDALANIB TURAR JOY BINOLARI QURISHNING ISTIQBOLI TOMONLARI. *Journal of new century innovations*, 18(1), 135-141.
  25. Kazadayev, A., Sharopov, B., Hakimov, S., Umarov, I., Muxtoraliev, M., Dadaxanov, F., & Abdunazarov, A. (2022). MAMLAKATIMIZDA NEMIS TA'LIM TIZIMINI JORIY QILISHNING SAMARADORLIGI TAHLILI. *Journal of new century innovations*, 18(1), 124-129.
  26. Sodiqjon, K., Begyor, S., Aleksandr, K., Farrukh, D., Mukhtasar, M., & Akbarjon, A. (2022). PROSPECTIVE ASPECTS OF USING SOLAR ENERGY. *Journal of new century innovations*, 18(1), 142-148.
  27. Mukhtasar, M., Begyor, S., Aleksandr, K., Farrukh, D., Isroil, U., Sodiqjon, K., & Akbarjon, A. (2022). ANALYSIS OF THE EFFECTIVENESS OF THE DEVELOPMENT OF THE GERMAN EDUCATION SYSTEM IN OUR COUNTRY. *Journal of new century innovations*, 18(1), 168-173.
  28. Dadaxanov, F., Sharopov, B., Umarov, I., Mukhtoraliev, M., Hakimov, S., Abdunazarov, A., & Kazadayev, A. (2022). PROSPECTS OF INNOVATIVE MATERIALS PRODUCTION IN THE BUILDING MATERIALS INDUSTRY. *Journal of new century innovations*, 18(1), 162-167.
  29. Begyor, S., Isroil, U., Aleksandr, K., Farrukh, D., Mukhtasar, M., Sodiqjon, K., & Akbarjon, A. (2022). MEASURES TO IMPROVE THE ENERGY EFFICIENCY OF MODERN AND RECONSTRUCTED BUILDINGS. *Journal of new century innovations*, 18(1), 157-161.
  30. Fathulloev A.M., Eshev S.S., Samiev L.N., Ahmedov I.G'., Jumaboyev X., Arifjanov S. Boglanmagan gruntlardan tashkil topgan uzanlarda yuvilmaslik tezliklarini aniklash [To the determination of non-effective speed in the beds containing from unconnected soils] // *Journal "Irrigatsiya va melioratsiya"*. Tashkent. – 2019. – C. 27-32.
  31. Arifjanov A., Akmalov Sh., Akhmedov I., Atakulov D. Evaluation of deformation procedure in waterbed of rivers // *IOP Conference Series: Earth and Environmental Science*. – IOP Publishing, 2019. – T. 403. – №. 1. – C. 012155.
  32. Arifjanov A., Samiyev L., Akhmedov I., Atakulov D. Innovative Technologies In The Assessment Of Accumulation And Erosion Processes In The Channels // *Turkish Journal of Computer and Mathematics Education (TURCOMAT)*. – 2021. – T. 12. – №. 4. – Pp. 110-114.
  33. Axmedov I.G'., Muxitdinov M., Umarov I., Ibragimova Z. Assessment of the effect of sedibles from sokhsoy river to kokand hydroelectric power station // *InterConf*. – 2020.
  34. Arifjanov A.M., Ibragimova Z.I., Axmedov I.G'. Analysis Of Natural Field Research In The Assessment Of Processes In The Foothills *The American Journal of Applied sciences*. – 2020. – T. 2. – №. 09. – Pp. 293-298.



35. Арифжанов А.М., Самиев, Л.Н., Абдураимова, Д.А., Ахмедов, И.Г. Ирригационное значение речных наносов [Irrigation value of river sediments] //Актуальные проблемы гуманитарных и естественных наук. – 2013. – №. 6.
36. Ахмедов И.Ф., Ортиқов И.А., Умаров И.И. Дарё ўзанидаги деформацион жараёнлаарни баҳолашда инновацион технологиялар [Innovative technologies in the assessment of deformation processes in the riverbed] // Фарғона политехника институти илмий-техника журнали. – Фарғона. – 2021. – Т.25, №.1. – С. 139-142.
37. Tadjiboyev S., Qurbonov X., Akhmedov I., Voxidova U., Babajanov F., Tursunova E., Xodjakulova D. Selection of Electric Motors Power for Lifting a Flat Survey in Hydraulic Structures // AIP Conference Proceedings 2432, 030114 (2022); <https://doi.org/10.1063/5.0089643>
38. Abduraimova D., Rakhmonov R., Akhmedov I., Xoshimov S., Eshmatova B. Efficiency of use of resource-saving technology in reducing irrigation erosion // AIP Conference Proceedings 2432, 040001 (2022); <https://doi.org/10.1063/5.0089645>
39. Холмирзаев С. А., Комилова Н. Х. Влияние сухого жаркого климата на ширину раскрытия трещин внецентренно-сжатых железобетонных элементов //Приволжский научный вестник. – 2015. – №. 4-1 (44).
40. Холмирзаев С. А. Температурные изменения в керамзитобетонных колоннах в условиях сухого жаркого климата //Журнал «Бетон и железобетон». – 2001. – №. 2.
41. Хамидов А. И. и др. Использование теплоизоляционного композиционного гипса в энергоэффективном строительстве. – 2021.
42. Хамидов А. И., Нуманова С. Э., Жураев Д. П. У. Прочность бетона на основе безобжиговых щёлочных вяжущих, твердеющего в условиях сухого и жаркого климата //Символ науки. – 2016. – №. 1-2. – С. 107-109.
43. Нуманова С. Э. Хамидов Адхамжон Иномжонович //ISSN 2410-700X. – С. 107.
44. Хамидов А. И., Ахмедов И., Кузибаев Ш. Теплоизоляционные материалы на основе гипса и отходов сельского хозяйства. – 2020.
45. Хамидов А. И. Использование теплоизоляционных материалов для крыш в энергоэффективном строительстве //Научно–технический журнал ФерПИ. Спец. – №. 2018.
46. Хамидов А. И., Мухитдинов М. Б., Юсупов Ш. Р. Физико-механические свойства бетона на основе безобжиговых щелочных вяжущих, твердеющих в условиях сухого и жаркого климата. – 2020.
47. Нуриддинов А. О., Ахмедов И., Хамидов А. И. АВТОМОБИЛ ЙЎЛЛАРИНИ ҚУРИЛИШИДА ИННОВАЦИЯЛАР //Academic research in educational sciences. – 2022. – Т. 3. – №. TSTU Conference 1. – С. 73-77.
48. Нуманова С.Э. Хамидов Адхамжон Иномжонович //ISSN 2410-700X. – С. 107.
49. Ризаев Б.Ш. Прочность, деформативность и трещиностойкость внецентренно-сжатых железобетонных элементов в условиях сухого жаркого климата. – 1993.
50. Yuvmitov A., Hakimov S. R. Influence of seismic isolation on the stress-strain state of buildings //Acta of Turin Polytechnic University in Tashkent. – 2021. – Т. 11. – №. 1. – С. 71-79.



51. Ювмитов А., Хакимов С. Исследование влияния сейсмоизоляции на динамические характеристики ЗДАНИЯ //Acta of Turin Polytechnic University in Tashkent. – 2020. – Т. 10. – №. 2. – С. 14.
52. Abdunazarov A., Soliev N. tudy of the performance of frameless construction structures under the influence of vertical stresses of ultra-submerged the lyoss soils //Студенческий вестник. – 2020. – Т. 28. – №. 126 часть 3. – С. 39.
53. Хошимов С. Н. У., Казадаев А. М. УСТАНОВКА ДООЧИСТКИ СТОЧНЫХ ВОД ОТ НЕФТЕПРОДУКТОВ //Вестник Науки и Творчества. – 2017. – №. 3 (15). – С. 147-150.
54. Ювмитов А. С., Казадаев А. М. ИССЛЕДОВАНИЕ РАСПРОСТРАНЕННЫХ ОШИБОК, ДОПУСКАЕМЫХ В ПРОЦЕССЕ СТРОИТЕЛЬСТВА ЗДАНИЙ И СООРУЖЕНИЙ, МЕРЫ ПО ИХ НЕДОПУЩЕНИЮ И УЛУЧШЕНИЮ КАЧЕСТВА СТРОИТЕЛЬСТВА //Central Asian Research Journal for Interdisciplinary Studies (CARJIS). – 2022. – №. Special issue. – С. 140-145.
55. Казадаев А. М., Обидинова Г.Ш., РОЛЬ МАЛОГО БИЗНЕСА И ЧАСТНОГО ПРЕДПРИНИМАТЕЛЬСТВА В РЕСПУБЛИКЕ УЗБЕКИСТАН // Теория и практика современной науки. – 2017. – №. 5 (23). – С. 1005-1008.
56. Umarov, S. A. (2021). Development of deformations in the reinforcement of beams with composite reinforcement. Asian Journal of Multidimensional Research, 10(9), 511-517.
57. Умаров, Ш. А. (2021). Исследование Деформационного Состояния Композиционных Арматурных Балок. TA'LIM VA RIVOJLANISH TAHLILI ONLAYN ILMIY JURNALI, 1(6), 60-64.
58. Abdugofurovich, U. S. (2022). BONDING OF POLYMER COMPOSITE REINFORCEMENT WITH CEMENT CONCRETE. Gospodarka i Innowacje., 24, 457-464.
59. Абдуллаев, И. Н., Умирзаков, З. А., & Умаров, Ш. А. (2021). Анализ Тканей В Фильтрах Систем Пылегазоочистки Цементного Производства. TA'LIM VA RIVOJLANISH TAHLILI ONLAYN ILMIY JURNALI, 1(6), 16-22.
60. Davlyatov, S. M., & Kimsanov, B. I. U. (2021). Prospects For Application Of Non-Metal Composite Valves As Working Without Stress In Compressed Elements. The American Journal of Interdisciplinary Innovations Research, 3(09), 16-23.
61. Умаров, Ш. А., Мирзабабаева, С. М., & Абобакирова, З. А. (2021). Бетон Тўсинларда Шиша Толали Арматураларни Кўллаш Орқали Мустаҳкамлик Ва Бузилиш Ҳолатлари Аниқлаш. TA'LIM VA RIVOJLANISH TAHLILI ONLAYN ILMIY JURNALI, 1(6), 56-59.
62. Тошпулатов, С. У., & Умаров, Ш. А. (2021). ИНСТРУМЕНТАЛЬНО-УЧЕБНО-ДИНАМИЧЕСКИЕ ХАРАКТЕРИСТИКИ СРЕДНЕЙ ШКОЛЫ И КОНСТРУКТИВНЫЕ РЕШЕНИЯ СРЕДНЕЙ ШКОЛЫ№ 2 Г. ФЕРГАНЫ. TA'LIM VA RIVOJLANISH TAHLILI ONLAYN ILMIY JURNALI, 1(6), 10-15.
63. Mamazonovich, M. Y., Abdugofurovich, U. S., & Mirzaakbarovna, M. S. (2021). The Development of Deformation in Concrete and Reinforcement in Concrete Beams



- Reinforced with Fiberglass Reinforcement. Middle European Scientific Bulletin, 18, 384-391.
64. Набиев, М. Н., Насриддинов, Х. Ш., & Кодиров, Г. М. (2021). Влияние Водорастворимых Солей На Эксплуатационные Свойства Наружные Стен. TA'LIM VA RIVOJLANISH TAHLILI ONLAYN ILMIY JURNALI, 1(6), 44-47.
  65. Hasanboy o'g'li, A. A. (2022). Stress Deformation of Flexible Beams with Composite Reinforcement under Load. American Journal of Social and Humanitarian Research, 3(6), 247-254.
  66. Hasanboy o'g'li, A. A. (2022). Stress Deformation of Flexible Beams with Composite Reinforcement under Load. American Journal of Social and Humanitarian Research, 3(6), 247-254.
  67. угли Ахмадалиев, А. Х., & угли Халимов, А. О. (2022, May). КОМПОЗИТНОЕ УСИЛЕНИЕ ИЗГИБАЮЩИЙ БАЛК ПОД НАГРУЗКОЙ. In INTERNATIONAL CONFERENCES ON LEARNING AND TEACHING (Vol. 1, No. 7, pp. 409-415).
  68. Сон, Д. О., & Халимов, А. О. (2021). УПРАВЛЕНИЕ МЕТРОЛОГИЧЕСКИМИ РИСКАМИ КАК ОСНОВА ДЛЯ УВЕЛИЧЕНИЯ КАЧЕСТВА ПРОДУКЦИИ. Экономика и социум, (2-2), 202-210.
  69. Бахромов, М. М. (2020). Исследование сил негативного трения оттаивающих грунтов в полевых условиях. Молодой ученый, (38), 24-34.
  70. Бахромов, М. М., & Рахманов, У. Ж. (2020). Проблемы строительства на просадочных лессовых и слабых грунтах и их решение. Интернаука, (37-1), 5-7.
  71. Mirzaeva, Z. A. (2021). Improvement of technology technology manufacturing wood, wood with sulfur solution. Asian Journal of Multidimensional Research, 10(9), 549-555.
  72. Мирзаева, З. А. К., & Рахмонов, У. Ж. (2018). Пути развития инженерного образования в Узбекистане. Достижения науки и образования, 2(8 (30)), 18-19.
  73. Abdullayev, I., & Umirzakov, Z. (2020). Optimization of bag filter designs (on the example of cement plants in the fergana region of the republic of Uzbekistan). Збірник наукових праць ЛОГОС, 31-34.
  74. Abdullayev, I. N., & Umirzakov, Z. A. (2021). Efficiency of Fabric in The Systems of Dust and Gas Cleaning of Cement Production.
  75. Абобакирова, З. А., & кизи Мирзаева, З. А. (2022, April). СЕЙСМИК ҲУДУДЛАРДА БИНОЛАРНИ ЭКСПЛУАТАЦИЯ ҚИЛИШНИНГ ЎЗИГА ХОС ХУСУСИЯТЛАРИ. In INTERNATIONAL CONFERENCES ON LEARNING AND TEACHING (Vol. 1, No. 6, pp. 147-151).