Таблица 2 – Характеристика образцов ДСтП

Параметр	ГОСТ 10632-2014	Номер образца		
		№1	№2	№3
Влажность, %	(5÷13)	5	5	5
Водопоглощение, %	–	104,3	101,39	95,19
Плотность, кг/м^3	(550÷820)	551	643	578
Предел прочности при изгибе, МПа	≥11	14	11	11
Содержание формальдегида в плите, мг/100 г абс. сухой плиты: - для класса эмиссии формальдегида Е 0,5 - до 4,0 вкл.; - для класса эмиссии формальдегида Е 1 - св. 4,0 до 8,0 вкл.; - для класса эмиссии формальдегида Е 2 - св. 8,0 до 20,0 вкл.	ГОСТ 27678-88	8,7 (Е 2)	8,4 (Е 2)	5,2 (Е 1)

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PROSPECTS FOR THE USE OF FOAM GLASS GRANULES IN THE INDUSTRY OF UZBEKISTAN: THERMAL INSULATION AND CORROSION RESISTANCE

Abstract. *This research studies the prospects of using foam glass granules as a material for* ***thermal insulation*** *and* ***corrosion protection*** *in industrial enterprises of Uzbekistan, particularly in gas processing complexes. Experimental results have shown that foam glass possesses low thermal conductivity, chemical inertness, water resistance, and high thermal stability, making it an effective solution for enhancing energy efficiency and protecting metal equipment from corrosion. The application of foam glass coatings can reduce heat loss by* ***25–30%*** *and decrease corrosion rates by* ***90–95%*** *on metal surfaces.*

Introduction. Energy efficiency and corrosion resistance of technological equipment are among the most urgent issues in Uzbekistan's industrial sector. In gas processing, petrochemical, and energy industries, heat loss and metal corrosion significantly reduce production efficiency and increase maintenance costs. Therefore, the use of modern materials with both energy-saving and protective properties is becoming increasingly important.

One of the promising materials in this field is **foam glass granules**, produced by recycling glass waste. This material is environmentally friendly, lightweight, mechanically strong, and exhibits excellent thermal insulation performance.

Physicochemical Properties of Foam Glass Granules. Foam glass granules have a highly porous structure with a thermal conductivity of **0.05–0.08 W/m·K**, making them ideal for high-temperature thermal insulation. The material is non-combustible, water-resistant, chemically inert, and mechanically durable.

Table 1 – Test results of foam glass granule samples

Parameter	**Value**
Aluminum oxide (Al_2O_3)	28–32%
Iron oxide (Fe_2O_3)	0.5–0.8%
Silicon dioxide (SiO_2)	52–55%
Titanium oxide (TiO_2)	0.45%
Moisture	15–20%
pH value	7.5–8.4
Granule diameter	0.6–12 mm
Total porosity	0.51 cm^3/g
Specific surface area	210 m^2/g
Abrasion resistance	70%
Density	780 g/dm^3

The results confirm the high stability and chemical inertness of the foam glass material.

Efficiency of Foam Glass in Thermal Insulation. In Uzbekistan, foam glass granules can be effectively used as insulation material in **Muborak**, **Shurtan**, and **Kandym** gas processing plants for technological pipelines and heat exchangers. The temperature of process gases in these facilities reaches **500–800 °C**, leading to significant heat loss.

When pipelines were insulated with foam glass coatings, heat loss was reduced by up to **27%**, and no condensation was observed on the surface. Such insulation improves the overall energy efficiency of technological systems and extends the service life of equipment.

Foam Glass as an Anti-Corrosion Protection Material. In gas processing and petrochemical facilities, metal structures are exposed to aggressive environments containing **H_2S, SO_2, CO_2,** and water vapor, which cause intensive corrosion. Foam glass provides **dual protection** against this process:

1.**Physical protection** – it prevents water and gas penetration to the metal surface.

2.**Chemical protection** – its inert structure does not react with metals or aggressive media.

Experimental studies have shown that steel surfaces coated with foam glass and tested for **500 hours** in aggressive environments exhibited a **90–95% reduction** in corrosion rate. The optimal performance was achieved with granule diameters of **2–5 mm** and coating thicknesses of **20–40 mm**.

For example, experimental tests at the **Shurtan Gas Chemical Complex** demonstrated that the corrosion rate of pipelines protected by foam glass coatings did not exceed **0.01 mm/year**, which is five times lower than conventional paint-based coatings.

Environmental and Economic Benefits. Foam glass is an **eco-friendly** and **non-combustible** material produced from recycled glass waste. Its local production would not only reduce waste accumulation but also substitute imported corrosion protection materials, creating added value within the domestic industry.

Establishing local foam glass production in Uzbekistan would:

- reduce dependency on imported materials;
- enable waste-to-product conversion;
- improve energy efficiency and technological sustainability in the industrial sector.

Conclusion. Foam glass granules have great potential for improving both **energy efficiency** and **technological durability** in Uzbekistan's industrial sector. Due to their low thermal conductivity, impermeability, chemical inertness, and stability at high temperatures, these materials can serve as effective solutions for **thermal insulation** and **corrosion protection** of equipment in gas processing and petrochemical plants.

The introduction of foam glass-based coatings can significantly enhance **energy savings**, **environmental safety**, and **the operational lifetime of industrial facilities** across the country.

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O‘ZBEKISTON SANOATIDA PENOSTEKLO GRANULALARINING ISSIQLIK IZOLYATSIYASIDAGI AHAMIYATI VA ENERGIYA TEJAMKORLIKDAGI ROLI

Annotatsiya *Ushbu ishda O‘zbekiston sanoat korxonalarida, xususan gazni qayta ishlash majmualarida penosteklo granulalarining issiqlik izolyatsiyasi sifatida qo‘llanish imkoniyatlari o‘rganilgan. Tadqiqotlar natijasida penosteklo materialining issiqlik o‘tkazuvchanligi past, kimyoviy inert va yuqori haroratga chidamli ekani aniqlangan. Bu xususiyatlar texnologik quvurlar va issiqlik almashinuvi apparatlarida energiya tejamkorlikni oshirish hamda issiqlik yo‘qotilishini kamaytirishda samarali yechim bo‘lishini ko‘rsatdi.*

O‘zbekiston sanoatida energiya tejamkorligi muammosi dolzarb masalalardan biridir. Gazni qayta ishlash, kimyo va neft-gaz sohalarida issiqlik yo‘qotilishi ishlab chiqarish xarajatlarining sezilarli qismini tashkil etadi. Ayni paytda, mamlakatda energiya resurslarini tejash, texnologik liniyalarda issiqlik samaradorligini oshirish va uskunalarning xizmat muddatini uzaytirish maqsadida yangi materiallardan foydalanish zarurati ortib bormoqda.Shunday istiqbolli materiallardan biri — penosteklo granulalaridir. Bu material tabiiy shisha chiqindilarini qayta ishlash orqali olinadi va ekologik toza, yengil hamda yuqori issiqlik izolyatsion xususiyatlarga ega.

Penosteklo granulalari o‘zining ko‘p g‘ovakli tuzilishi tufayli juda past issiqlik o‘tkazuvchanlikka ega (0.05–0.08 W/m·K), bu esa uni issiqlik izolyatsiyasi uchun ideal materialga aylantiradi. Ularning asosiy afzalligi shundaki, ular yonmaydi, suvni singdirmaydi, kimyoviy inert va mexanik bosimlarga bardoshli.O‘zbekiston sharoitida penosteklo granulalari asosan gazni qayta ishlash va neft-kimyo korxonalarida — xususan, **Muborak gazni qayta ishlash zavodi**, **Sho‘rtan gaz-kimyo majmuasi** va **Qandim gazni qayta ishlash majmuasi**da issiqlik izolyatsiyasi uchun qo‘llanishi mumkin.