Spanish Journal of Innovation and INTEGRITY
ISSN: 2792-8268
Volume: 40, Mar-2025
http://sjii.indexedresearch.org

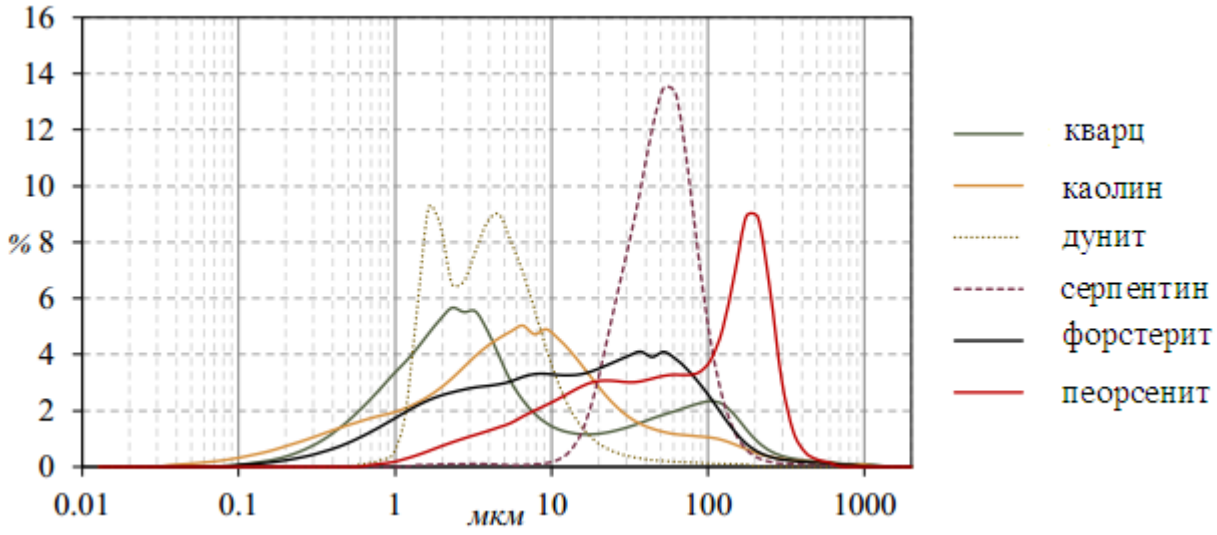
Stabilization Processes of Ceramic Materials Based on Local Raw Materials Processed in a Solar Device

A. I. Mustafoyev, M. O. Mustafoyeva, B. G. Kodirov, F. E. Rakhmanova
Mirzo Ulugbek named after Uzbekistan National University Jizzakh branch, Samarkand state medicine university
mustafoyevakmal@gmail.com

Abstract: *This paper describes the composition and properties of heat-resistant ceramic materials based on a large solar array and based on recycled local raw materials. It presents a microanalysis of a sample of serpentine mixture in the initial state and after 672 hours of mixing, and an optical scanning electron microscopy study, showing the composition, thermal decomposition, X-ray of the serpentine mineral.*

Keywords: *Serpentine, amesite, thermal decomposition, X-ray, mixture.*

The particle size of serpentine minerals was determined by measuring the intensity of light scattered by dust particles dispersed in a liquid medium when irradiated with laser diffraction in accordance with the international standards ISO 24235 on a Malvern Masterizer 2000 analyzer. The particle size distribution is shown in Figure 1. In addition, to qualitatively assess the effect of the average value of the sample, n consisted of two, three and five-component mixtures of minerals. The average refractive index of the mixture was calculated based on the volume fractions of the minerals in the mixture. The properties of the mixtures are given in Table 1. Theoretical calculations of the particle size distribution in the mixtures were made based on the distribution obtained for serpentine minerals and their volume of participation in the mixture. For quantitative evaluation, two-component mixtures of magnesium oxide and silica were prepared with a mixture ratio of 1:9 to 9:1, with the proportion of each mineral in the mixture varying from 10 to 90 and from 90% to 10%, respectively.



1 . Particle size distribution in pure minerals.

Properties of studied mineral mixtures

Number of mixture	Minerals	Volume fraction
1.	serpentine	0.36
	dunite	0.24
	peorsenite	0.22
	quartz	0.06
	kaolin	0.04
	forsterite	0.08

The natural appearance of serpentine is shown in Figure 2. Serpentine powder was sieved through a 60-micron sieve and X-ray phase analysis (XRF) was performed. The powder method was used to analyze the initial powder products and mixed composite materials. The analysis was carried out using a nickel (Ni) filter under CuKα radiation at a rotation speed of 2 $^{\text{rpm in the range of angles}}$ $2\theta = 5\ ^{0} - 70\ ^{0.}$ The Crystallographica Search Match software package and the JCPDS file cabinet were used to identify compounds in the XRF composition. Figure 3.

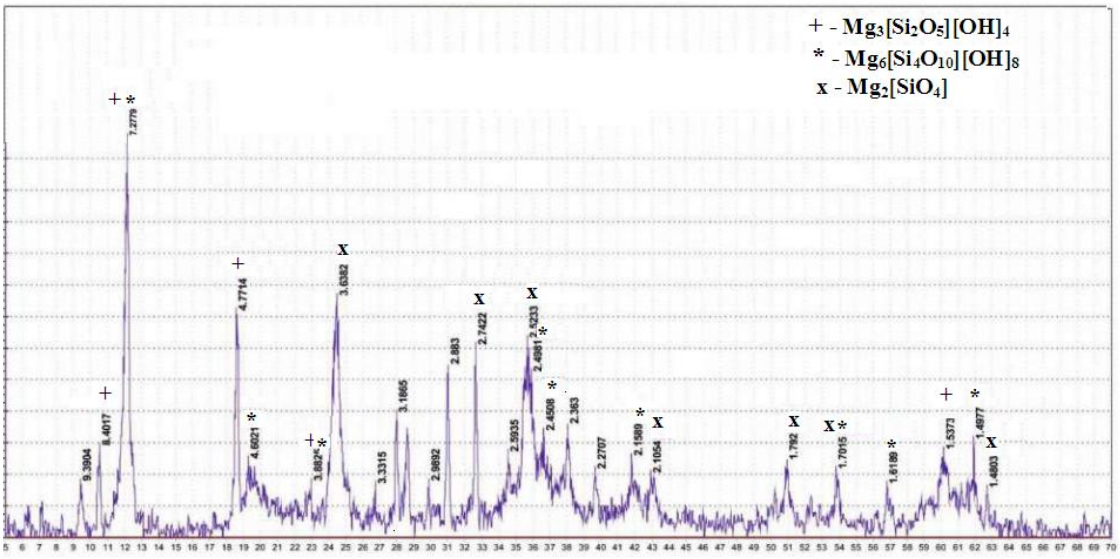
$700\ ^{0}$ C refers to low temperatures. Thermal decomposition (dehydration) of serpentine, according to X-ray data, ends at $700\ ^{0}$ C. The components in the mixture are magnesium oxide from 35% to 70%, magnesium chloride from 5% to 25%, and water from 20% to 40%. When the flow rate of the magnesium chloride solution is less than 36%, it can be seen that the change in the magnesium chloride composition in both directions reduces the mechanical strength of the sample. With an increase in the amount of solution, the mechanical strength increases to 80 kg / cm 2 , if the concentration of magnesium chloride is higher than 58% . Considering the variability of the volume formed as a result of the increase in magnesium chloride, it can be called an optimized ratio.

The total amount of evaporated water in serpentine and the loss on ignition, which characterizes the gaseous phase, is 13.45%. It shows a gradual dehydration of serpentine from 110 0 C to 810 0 C. After the end of dehydration, crystallization of forsterite occurs in the temperature range from 800 0 C to 870 0 C. At 834 0 C, an exothermic effect is observed, the peak of which corresponds to the crystallization of forsterite 2MgOSiO 2 .

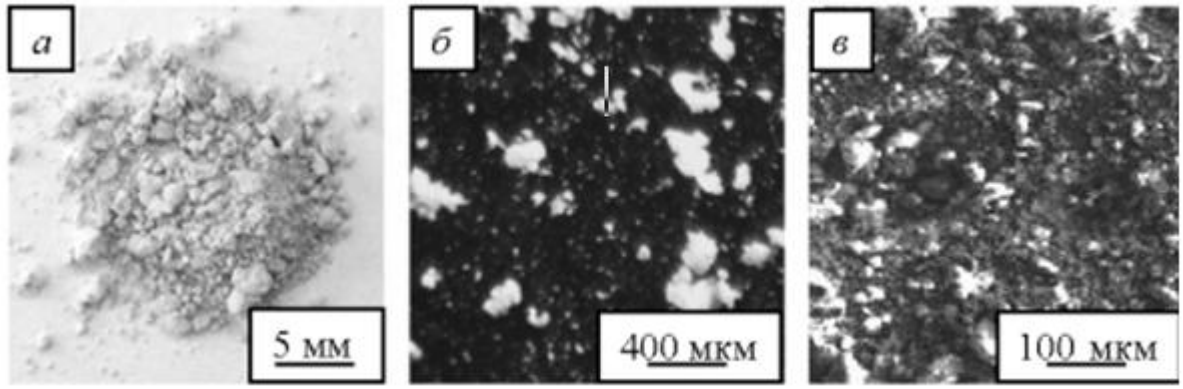
Microscopic and metallographic studies of serpentine: Scanning electron microscopy (SEM) studies were performed on a Quanta 200 microscope, and local chemical microanalysis was performed using an EDAX X-ray microspectral analyzer - Figures 4 - 5.

Spanish Journal of Innovation and INTEGRITY
ISSN: 2792-8268
Volume: 40, Mar-2025
http://sjii.indexedresearch.org

2 . Natural appearance of silver serpentine.



3 . X-ray image of silver serpentine powder.



4 . Serpentine powder, optical (a,b) and SEM image of the powder (c)

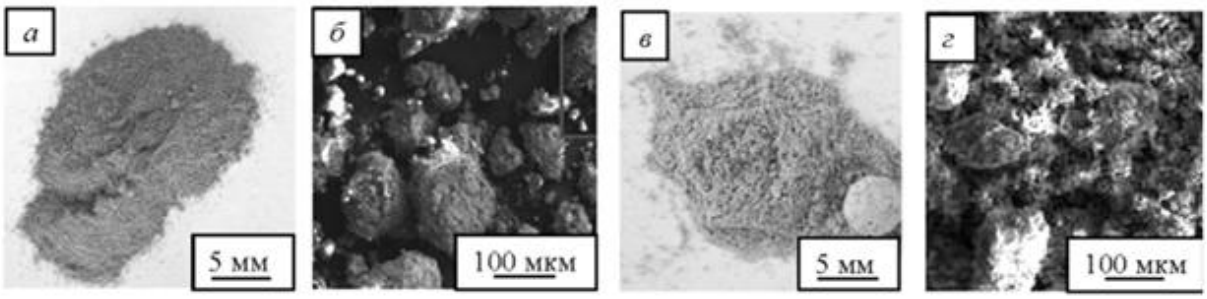


Figure 5. Sample of iron powder and serpentine mixture in the initial state (a, b) and after 672 hours of mixing (b, g) and optical SEM – (a,v)

Serpentine powder is shown in Figure 4a . It has a characteristic gray-green color and consists of agglomerates of adhesive particles up to 50 microns in size and micron-sized particles, which are the finest spiral fibers and parts of serpentine plates (Figure 4b). Agglomerates are collections of particles up to 10 microns in size (Figure 4c).

After 672 hours of mixing, the initial mixture (Figure 5a) turns into a mixture of granules (Figure 5b). SEM showed that the granules consist of iron particles surrounded by serpentine particles (Figure 5c) . This affects the results of energy dispersive analysis. Since the spectra are taken from a thin surface layer of the cast layer, the iron fraction in the spectrogram decreases.

To analyze the structure of the samples, abrasive sections were made on the cross-section of the sample or its area up to 1 cm ^{2} . Diamond abrasive materials were used as the abrasive material for the selected sections. Metallographic examination of the samples was carried out on a MEJI -7200 optical microscope with a magnification of 1000*. The average grain size was determined using the Thixomet program.

List of used literature.

1. Каримов А. А., Мустафоев А. И. Технология керамики для материалов электронной промышленности: монография //Ташкент: Типография ТИИИМСХ.–2020. – 2020.
2. Mustafoyev A. Технология керамики для материалов электронной промышленности //Scienceweb academic papers collection. – 2020.
3. Мустафоев А. И. и др. Влияние нагрева на фазовые превращения в геомодификаторе трения на основе слоистого серпентина //AGRO ILM» журнали. – Т. 4. – С. 97-99.
4. Kodirov B. et al. Silicon carbide synthesis in a solar oven from natural raw materials //E3S Web of Conferences. – EDP Sciences, 2024. – Т. 508. – С. 01005.

5. Suvanova L. S. et al. Studying the technological possibilities of the large sun face in the localization of imported jewelry stones //American Institute of Physics Conference Series. – 2022. – Т. 2432. – №. 1. – С. 020016.
6. Муратов И. М. и др. Супероксидный катализ металлокомплексами порфиринов и фталоцианинов //Universum: химия и биология. – 2022. – №. 6-2 (96). – С. 41-44.
7. Мамадиярова Х., Юсупова С., Рахманова Ф. Об изучении процесса получения дефолианта на основе хлората натрия и аминогуанидинфосфата. – 2021.
8. Рахманова Ф. Э.Роль оксида азота в физиологии человека: механизмы действия, функции и влияние на здоровье 2024/11/3 Журнал Биология ва тиббиёт муаммолари Т -6 №157 С 336-340
9. Рахмонова Ф. Э. Нейропротективные, гипотензивные, антигипоксические свойства шпината //o'zbekistonda fanlararo innovatsiyalar va ilmiy tadqiqotlar jurnali. – 2025. – Т. 3. – №. 36. – С. 212-216.
10. Тургунов Д. Э., Рахманова Ф. Э., Каржавов А. Р. Терапевтическое применение и токсичность шафрана //Universum: медицина и фармакология. – 2023. – №. 4-5 (98). – С. 47-51.
11. Fayzullayev N., Akmalaiuly K., Karjavov A. Catalytic synthesis of a line by acetylene hydration //Известия НАН РК. Серия химии и технологии. –2020.
12. Karjavov A. R., Fayzullaev N. Determination of technological parameters of producing vinylchloride from acetylene //AIP Conference Proceedings. –AIP Publishing, 2024.