ENERGY-SAVING AND ENVIRONMENTALLY FRIENDLY TECHNOLOGIES FOR VOLCANIZATION OF ELASTOMERIC COMPOSITIONS

Nazarov Erkin Sadikovich

Bukhara State University, candidate of technical sciences, associate professor nazarov.es68@mail.ru

Kamolov Jo'rabek Jalol o'g'li, Sobirov Shohjahon Ochil o'g'li

Bukhara State University, master's students of the Department of Physics

sobirovshox1196@gmail.ru

https://doi.org/10.5281/zenodo.6577108

Annotation: *The current stage of scientific and technological progress is largely determined by the creation of an effective energy-saving and environmentally friendly technology for producing composite polymer and elastomeric materials with improved performance properties. Among the various composite elastomeric materials, rubberized fabrics, conveyor belts, which are in great demand in construction, mining and a number of other sectors of the national economy, are of particular importance. The main, final stage of the production of the above types of rubber products is the vulcanization process, on which the properties of the resulting composite elastomeric materials depend. In the general problem of vulcanization of composite elastomeric materials, great importance is attached to the creation of an energy-saving and environmentally friendly technology that ensures a decrease in the emission of toxic exhaust gases into the atmosphere and eliminates the danger of premature vulcanization at the stages of mixing, storage and processing.*

Keywords: *Composite materials, irradiation efficiency, IR emitter, vulcanization, elastomeric composition, composites structure, vulcanization kinetics, physico-mechanical properties of composites.*

The existing traditional technology of vulcanization of rubber compounds with high temperature sulfur is carried out at high pressure (≥ 10 MPa) and high temperature (≥ 416 K), which worsens the environmental

conditions due to the release of toxic gases. In this regard, it is important to reduce the amount of electricity consumed while maintaining radiation efficiency. In this regard, vulcanization of elastomers by means of ceramic IR emitters allows the process to be carried out at a relatively low power (20-60 W) with a sufficiently high absorption capacity. Distinctive features of ceramic IR emitters are the stability of thermal, physical and chemical parameters, which ensure the specificity of the composition and structure of the composition.

Today, IR diffusers used for vulcanization of rubber products are characterized by low absorption capacity and relatively high power consumption due to the wide range of wavelengths, which limits the scope of their use.

The study of the kinetics of the vulcanization process in the presence of visible and invisible rays allows to reveal a number of general laws of vulcanization of elastomers, which are important in the formation of the structure of composite elastomeric materials. In this regard, the study of vulcanization of elastomeric compositions under the influence of ceramic IR-light emitters and the impact of the specificity of their composition and structure on the vulcanization process is of great interest. Due to the narrow frequency range of IR-rays generated when ceramic IR-emitters are heated, it is possible to carry out the vulcanization process in a relatively short period of time with a sufficiently high efficiency. The kinetics of vulcanization of elastomeric compositions has been studied by the method of superposition at different powers of the light source. Vulcanization was carried out on standard rubber plates with a thickness of 2 mm at a power of 20-60 W of IR radiation. The surface temperature of the ceramic emitter was sensed using a sensor and was 140-1500C. The degree of vulcanization was assessed by the change in the number of cross-chemical bonds and the amount of sol-gel fraction over time in elastomeric compositions. The rate of vulcanization was determined by the amount of sulfur in the vulcanizers. It was shown that the

vulcanization rate increases with the duration of irradiation.

Comparing the obtained results, it can be noted that the greatest rate of vulcanization was observed in crystalline SKI-3 rubber-based rubber compounds. A study of the effect of IR radiation power on vulcanization kinetics showed that the degree of adhesion of vulcanizers increases with increasing radiation power, as evidenced by the increase in the number of cross-chemical bonds. It should be noted that the highest level of adhesion of vulcanizates was reached when the IR-irradiance was 60 W. Very interesting results were obtained when studying the rate of structuring by the sol-gel method. The results show that the degree of aggregation of rubber macromolecules often depends on the strength of the IR radiation source, which leads to the formation of transverse polysulfide bonds. The results of the study of the kinetics of volcanic eruptions allow us to determine the density of the network. Kinetic data show that the rate of agglomeration of vulcanizates decreases with increasing IR intensity.

Studies on the kinetics of vulcanization of elastomers under the influence of ceramic IR emitters have shown the specificity of their mechanism of action. First of all, this is due to the peculiarities of the composition and structure of functional ceramic-based IR emitters. By selecting the chemical composition of the functional ceramic, it can be assumed that, unlike traditional incandescent lamps and halogen lamps, which produce light energy over a wide range of temperatures when heated, IR rays can be wavelength-adjusted. Due to their special chemical composition, the proposed ceramic compositions are characterized by a short wavelength range (750-1500 nm).

The above-mentioned short-spectral effects of IR-rays generated in ceramic converters play an important role in the structuring of elastomers, which suggests that the vulcanization rate of elastomers is higher than that of conventional incandescent IR-rays. provides When the macromolecules of

rubber are exposed to an impulse, part of the energy is absorbed due to the low thermal conductivity of the composition, and part is used to heat the mass, thereby accelerating the vulcanization process. Kinetic studies have led to the creation of optimal vulcanization regimes. Research in this area has been conducted at a power of 20 W to 60 W. As a result, it has been shown that the vulcanization rate increases with increasing IR-irradiance and the time to reach the maximum vulcanization level decreases.

It is known that the technical properties of rubbers depend not only on the nature of the ingredients and binders, but also on the conditions of vulcanization. Therefore, the issue of determining the effect of a new impulse approach to vulcanization of elastomeric compositions on the technical properties of vulcanizers is of renewed interest. Based on the set tasks, the effect of ceramic IR-reflecting power on the elastic-strength properties of model rubbers was studied. At the same time, an increase in the value of the conditioned voltage at elongation was noted with an increase in IR radiation power from 20 to 60 W. This effect was most pronounced in SKMS-30ARKM-15 rubber-based elastomer compositions. As the IR-irradiance increases, the conditional strength (R) of the composites also increases, while the relative length (Lnis) decreases. It should be noted that the value of the conditional stress is also significantly affected by the vulcanization time. It is known that the mode and conditions of vulcanization often determine the dynamic characteristics of vulcanizations. In this regard, the study of the effect of IR radiation on the dynamic properties of vulcanizates, which is an important indicator of the performance of composites, is of great interest. As mentioned above, due to the smooth flow of vulcanization in elastomeric compositions as a result of impulse action, favorable conditions are created for increasing the dynamic resistance of composite elastomeric materials. The study of the dynamic characteristics of vulcanized rubbers showed that during the vulcanization of composites under the influence of ceramic IR-modifiers, their dynamic

dynamics increased. properties, and this is ensured by the specificity of the exposure of IR rays, in particular to the occurrence of structural changes in the elastomers due to the depth of their penetration and the narrowness of the range of exposure of the spectra. In most cases, the use of many polymer composite materials is carried out in conditions of incomplete relaxation processes. Due to the vibration of the chains in the polymer during deformation, they undergo processes related to the displacement of their sections, because the flexibility of chain macromolecules is a factor that determines the whole complex of mechanical properties of polymers. Accordingly, it is important to observe the effect of the impulse effect on the relaxation coefficient of the volcanic state as it is compressed along the axis.

REFERENCES

1. Ивалун С.Н. Полимерные нанокомпозиты. *Природа. 2000. №7.* С.13-17.

2. Назаров Э.С., Юсупбеков А.Х. Вулканизация резиновых смесей на основе каучука СКМС-30 АРКМ-15 под действием керамических ИК - излучателей. *Каучук и резина, 2005. №2.* С.29-30.

3. Назаров Э.С., Тураев О.Г. Научные основы использования минеральных ресурсов. *Международный академический вестник. 2019. № 12* (44) Уфа. С. 84-86.

4. Назаров Э.С., Тураев О.Г. Перспективные направления в технологии композиционных материалов. *Международный академический вестник, 2018. №6* (26) С.75-78.

5. Назаров Э.С., Собиров Ш.О. Условия ультразвукового диспергирования слоистых минералов. *Проблемы и достижения современной науки. 2018. № 2* (1), С.74-75.

6. Назаров Э.С., Тураев О.Г. Перспективные достижения в области технологии композиционных эластомерных материалов. *Наука и общество в условиях глобализации. 2016.* 62-65.