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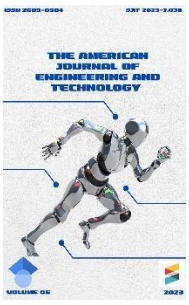

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Research Article

INVESTIGATION OF STRENGTH PROPERTIES OF RADIATION-MODIFIED POLYMER COATINGS

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Tojiboyev Begijon Mamitjonovich
Associate Professor, Andijan Machine Building Institute, Uzbekistan

Yakubjonov Fayzulloh Tursunali O‘G‘Li
Assistant Teacher, Andijan Machine Building Institute, Uzbekistan

Xojimatov Umidbek Turg‘unboy O‘g‘li
Assistant Teacher, Andijan Machine Building Institute, Uzbekistan

ABSTRACT

One of the methods for improving the properties of polymer coatings is radiation treatment. It is mainly carried out by ultraviolet rays and ionizing radiation. There are several types of ionizing radiation: radiation caused by deep changes in the electron shell and the nucleus of the atom and having the nature of electromagnetic oscillations, x-ray and γ-radiation; streams of charged particles that can have both positive and negative charges.

KEYWORDS

Oscillations, x-ray and γ-radiation; streams of charged.

INTRODUCTION

Changes in the physical properties of the coating (adhesive) and the substrate (substrate) subjected to the action of radioactive radiation, both on the nature and energy of the bombarding particles.

Table 1 shows the adhesion properties and internal stresses of irradiated γ-rays coated and high-density polyethylene of different melt index on the surface of the steel substrate. The irradiation was carried out with the Co60 isotope in a γ-beam setup: the temperature in the beam is no more than 460C, the atmospheric pressure is from 714 to 718 mm. gt; Art. dose rate - 330 roentgen / sec. The samples were subjected to γ - irradiation 24 hours after the preparation were tested four days after γ - irradiation.

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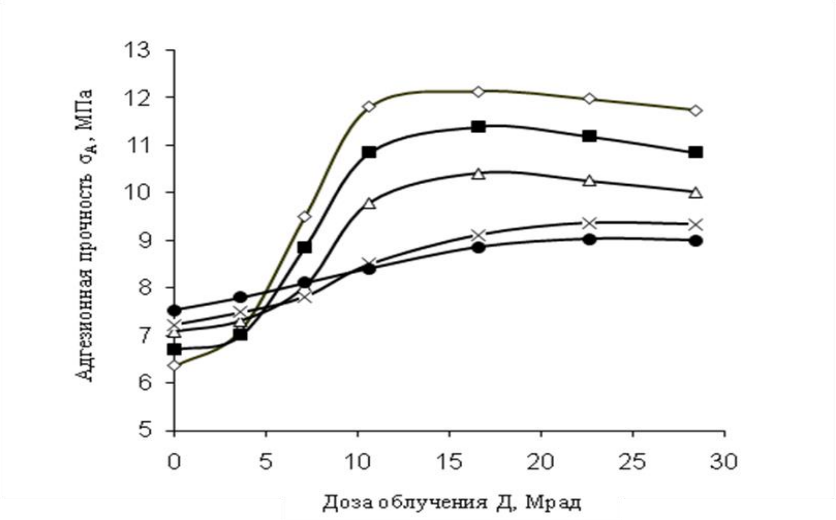
Table 1

Adhesion and internal stresses in polyethylene coatings after γ-irradiation

Melt index , i, r/10 min	The dose of irradiation, Mrad						
	0	3,6	7,1	10,6	16,6	22,5	28,4
Adhesive strength, MPa							
0,52	6,37	7,12	9,52	12,01	12,14	11,98	11,75
1,51	6,71	7,01	7,28	7,75	9,62	9,86	9,88
3,12	7,09	7,31	7,62	8,16	9,36	9,69	9,72
6,59	7,22	7,49	7,82	8,51	9,12	9,37	9,34
10,70	7,54	7,81	8,12	8.41	8,87	9,04	9,01
Internal stresses in the coating, MPa							
0,52	4,84	4,02	3,63	3,58	3,50	3,42	3,38
1,51	4,04	3,44	3,19	3,02	2,83	2,76	2,72
3,12	3,23	2,85	3,66	2,42	2,26	2,24	2,16
6,59	2,44	2,09	1,96	1,87	1,81	1,73	1,64
10,70	1,87	1,54	1,48	1,43	1,41	1,34	1,26

The obtained results show that the adhesion strength of coatings up to a certain dose of irradiation increases by 20 - 90% depending on the melt index of polyethylene, and further hanging of the radiation dose leads to its reduction. A greater increase in the adhesive strength is observed in polyethylene of a lower melt index.



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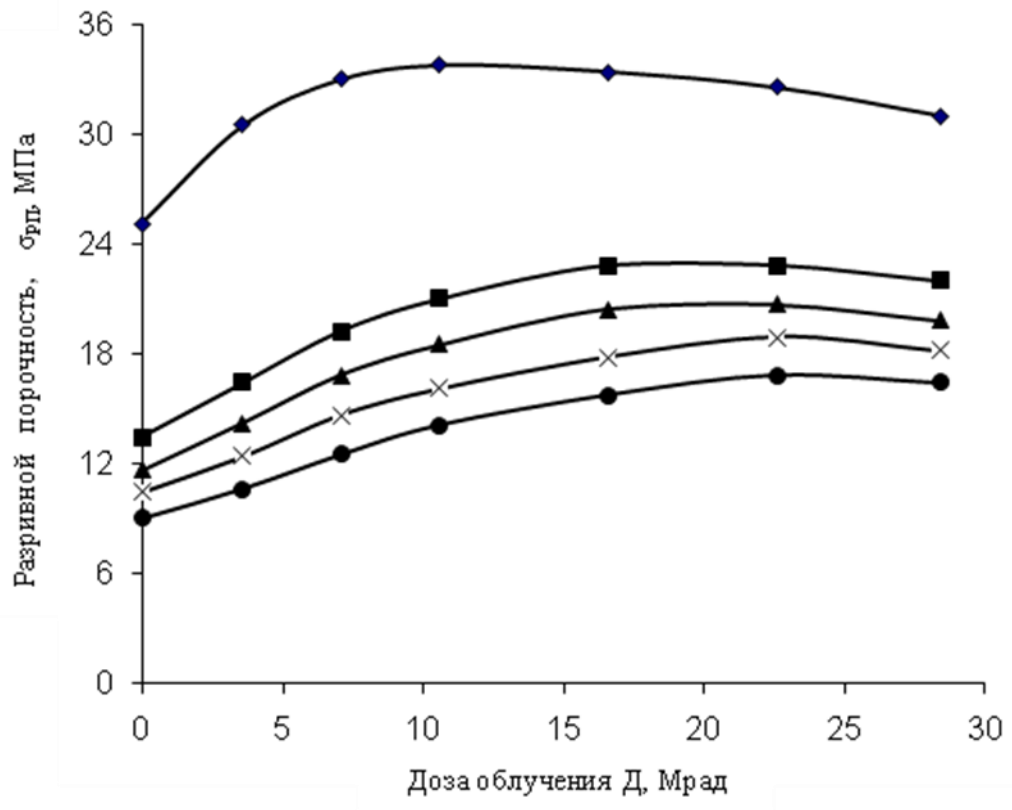
Pic-1. Dependence of the adhesive strength of polyethylene coatings before and after irradiation

The increase in adhesion is associated with an increase in the mobility (flexibility) of segments of macromolecules, the enhancement of ionization processes in the polymer and metal, as well as an increase in the defectiveness of the crystalline substrate. This, apparently, leads to an increase in the donor ability of the substrate and acceptor adhesion, or vice versa. In addition, radiation-chemical oxidation of polyethylene occurs in the contact zone, which promotes favorable orientation of the carbonyl groups relative to the oxide film of the metal substrate. As a result, it is possible to increase the power of the micro capacitor created by the double electric layer at the interphase boundary and to enhance the diffusion processes between the adhesive and the substrate. It is possible that after the γ-irradiation, other components of the adhesive strength of polymer coatings of metals also increase.

The dose of irradiation has a significant influence on the tensile strength of film coatings, which, before a certain radiation dose (10-100, Mrad), increases, and then decreases.



Pic-2. Effect of irradiation on the tensile strength of polyethylene coatings

The increase in the rupture strength of the coating film with γ-irradiation, despite the decrease in the degree of crystallinity of the polymer, is explained by the crosslinking of its macromolecules, since the breaking strength of the crosslinkable polymers depends more on the crosslinking density (up to a certain irradiation dose) than on the degree of crystallinity.

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Reducing the tensile strength of the coating film after a certain radiation dose is associated with radiation-chemical degradation, since destruction predominates over crosslinking of polymer macromolecules and leads to a decrease in the strength properties of the coatings.

With an increase in the melt index of polyethylene, the extremum of the tensile strength is shifted to the region of large doses of irradiation. This is obviously explained by the need for more energy to crosslink polyethylene macromolecules with lower density. After γ-irradiation, the strength of the films increases by 40-70%. A large percentage increase is observed in polyethylene with a high interest in the melt.

Internal stresses in polyethylene coatings have a complex character depending on the dose of irradiation, that is, at lower doses decreases, and at large - increases. With a further increase in the radiation dose, the internal stress in the coatings tends to sharply decrease.

Reduction of internal stresses in coatings at low radiation doses is explained by the acceleration of relaxation processes and restructuring of the supramolecular structure of the polymer. The increase in internal stresses with increasing irradiation dose is associated with an increase in shrinkage and specific density of the coating as a result of crosslinking of polymer macromolecules. A sharp decrease in internal stresses in the coatings with a further increase in the irradiation dose is due to the predominance of destruction of the crosslinked macromolecules of the coating material.

The lowest internal stresses in polyethylene coatings are observed in the irradiation intervals from 10 to 30 Mrad. In this case, the internal stresses in the coatings are reduced to 50%, depending on the melt index of the high-density polyethylene.

A further increase in the irradiation dose, despite the fact that it increases the tensile strength of the coating film, reduces the adhesive strength and increases the internal stresses in the coating. As a result, the values of the safety factors for the tensile and adhesive strength are reduced and, thus, the properties of the coating deteriorate.

Thus, for irradiation treatment of polyethylene coatings in order to increase the adhesion strength and other physical and mechanical properties, radiation doses in the ranges from 10 to 30 Mrad can be recommended, depending on the melt index and the type of polyethylene.

REFERENCES

1. Б.М.Тожибоев, А.Р.Баймирзаев Темир-композит материалларидан подшипник деталларини олиш учун печ танлаш ва қолиплаш учун формасини тайёрлаш Kompozitsion materiallar Ilmiy-texnikaviy va amaliy jurnali Toshkent, 2006. №2/2021 297-299 ст.
2. Б.М.Тожибоев Вопросы улучшения прочностных свойств полимерных композиционных покрытий. UNIVERSUM: ТЕХНИЧЕСКИЕ НАУКИ Выпуск: 12(93) Декабрь 2021 научный журнал. – № 12(93). Часть 2. 22-23 ст.
3. B.M.Tojiboyev, L.Olimov B.Ramashliyev Investigation of Strength Properties of Radiation-Modified Polymer Coatings International Journal of Trend in Research and Development 2018 422-423 ст.
4. Зиямухамедова У.А., Тожибоев Б.М., Собиров Б.А., Муродуллаева Г.Б., Джумабоев А.Б.Исследование возможности комплексного применение композиционных материалов на основе из местного сырья Научно-технический журнал ФерПИ-2019 47-51 ст.
5. Abdujalol, B., Nodir, T., Fakhriddin, M., Nuriddin, T., Kamola, T., & Nargiza, S. (2022). Development of steel wheel detail casting technology. Asian Journal of Multidimensional Research, 11(8), 82-88.
6. Ataxonova, S. Q. (2021). METALLARNI SIFAT NAZORATINI TEKSHIRISH USULLARINI TAHLIL

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QILISH JARAYONLARINI TAKOMILLASHTIRISH. Oriental renaissance: Innovative, educational, natural and social sciences, 1(10), 124-135.

7. Ataxonova, S. Q. (2021). METALLARNI SIFAT NAZORATINI TEKSHIRISH USULLARINI TAHLIL QILISH JARAYONLARINI TAKOMILLASHTIRISH. Oriental renaissance: Innovative, educational, natural and social sciences, 1(10), 124-135.

8. Jalilov Rakhimjon Ravshanbek o'g'li. "CLADDING TILE PRODUCTION USING MAGNESIUM OXYCHLORIDE CEMENT MORTAR IMPROVED BY DIFFERENT WASTES." Gospodarka i Innowacje. 35 (2023): 276-278.