68,66 мН/м, кута змочування від 69 до 77°, зменшується величина коефіцієнту змочування від 0, 67919 до 0,61251 та робота сил адгезії від 89,87 до 84,11 мН/м, але збільшується показник водостійкості клейового шву. З технологічної точки зору, найбільш доцільно для врегулювання реокінетичних і колоїдно-хімічних характеристик клею, вводити до його складу алюмінати кальцію в кількості 5%, що забезпечуватиме близькі по значенню кут змочування та коефіцієнт змочування до деревини сосни.

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IMPROVING THE ENERGY EFFICIENCY OF TRANSLUCENT STRUCTURES WITH USING OF SPECIAL PURPOSE GLASSES

The advantages of translucent facades are the modern appearance of buildings and structures, the ability to embody bold architectural and design solutions, the natural lighting of rooms, the possibility of visual combination with the external architectural environment, increasing the surface of buildings.

Ensuring the energy efficiency of translucent glass structures, including windows, balcony doors, storefronts used in buildings and structures, provides for minimal total energy costs not only for heating, but also for the conditioning and lighting of the premises.

Modern translucent structures are represented mainly by double-glazed windows, in the application of which heat losses are reduced due to the improvement of the window design and the use of new materials. Double-glazed windows should allow the maximum amount of light to be transmitted and at the same time minimally affect energy consumption for heating or cooling the room. The use of special-purpose glass allows to obtain a modern double-glazed window with different functional characteristics.

According to the State Building Codes of Ukraine, the value of the heat transfer resistance of windows, balcony doors, storefronts and light transparent facades should be at least 0,6 m^2K/W. For glazing of

windows and balcony doors it is necessary to use double-glazed windows of class 1 (heat transfer resistance 0,6…0,64 m^2°C/W) and class 2 (heat transfer resistance 0,65…0,84 m^2°C/W). In the construction of energy efficient buildings, it is recommended to use double-glazed windows of class 3 (heat transfer resistance of 0.85…1.24 m^2°C/W) and class 4 (heat transfer resistance of more than 1.24 m^2°C/W).

Constructive improvements of glass units include the creation of different numbers of cameras; use of a window block of a separate design with two rows of glazing; choice of glass thickness, optimal distance between glasses; change of design of frame, imposts, shutters, increase of tightness of window blocks.

Improvement of materials involves the use of a certain type of glass, as well as the appropriate type of profile (aluminum, PVC, wooden). The highest performance figures are wood profiles and PVC profiles. There is a practice of constructing structures according to standardized indicators (not less than 0.6 m^2K/W) from aluminum profiles (0.3…04 m^2K/W) or ordinary PVC profiles (less than 0.55 m^2K/W) due to the increased indicators of thermal resistance used double-glazed windows (0.65… 0.85 m^2K/W).

Solution of problems of energy efficiency of glass constructions is development of double-glazed windows with use of glasses with special coatings containing silver and dielectric: low-emission and sun-protection (with pyrolytic and magnetron sputtering).

Due to the modification of glass (tinting, introduction of chemical additives) it is possible to significantly regulate energy losses. The surface emitter (E) of ordinary glass has a numerical value of E = 0.835 and a selective one of less than 0.04. This means that the emission of selective glass is one order of magnitude lower than that of ordinary glass. The low-emission glass emission factor (0.17) is much lower than ordinary glass (0.9), which results in improved thermal insulation properties of the former.

In modern translucent structures, low emission I-glass with magnetron sputtering of silver and titanium oxide is used, which has a much higher thermal insulation capacity than ordinary glass. The heat transfer resistance of single-glazed windows using such glass is higher than double-glazed windows using ordinary glass.

I-glass with low emission Double Low-E coating has high light transmittance and even lower emissivity (E = 0.04) compared to K-glass.

The use of double-glazed windows with I-glass in the composition can not only achieve a reduction in energy consumption, but also significantly increase the comfort of the room.

I-glass has good thermal insulation properties (K = 1.3… 1.1) and the ability to transmit solar and thermal energy (SF 62). I-glass is 1.5 times the K-glass in its heat-retaining properties. It is estimated that such glass can reduce electricity costs by approximately 30%.

The value of the emissivity of ordinary glass - 0,83; K-glass – 0.2, I-glass – 0.04...1.2. Thus, I-glass by its heat-retardant characteristics can exceed ordinary glass 21 times, and K-glass - 5 times.

To reduce the cost of the process of conditioning the premises when creating light-transparent structures used sunscreen or multifunctional (which combines the functions of energy conservation and protection against insolation).

The most effective are multifunctional (combination) glasses that combine sunscreen and energy-saving properties. Coatings can be pyrolytic or magnetron - they provide high light transmission and low reflectivity, as well as provide good thermal insulation, which in combination with sun protection provides comfortable conditions in the room.

Instead of air, inert gases (argon, krypton) or a mixture of gases are used to fill the space between the windows in the double-glazed windows, which significantly improves the thermal and sound insulation properties of the double-glazed windows.

It should be noted that the coefficient of heat transfer of double-glazed windows with ordinary float glass is 2.8 W/(m^2·K), then the heat transfer coefficient of the same double-glazed window with K-glass is 1.9 W/(m^2·K), and in the case of I-double-glazed window with argon inside will be 1.3 W/(m^2·K). I-glass has improved thermal performance compared to K-glass. In the cold season, the internal temperature of the building with double-glazed windows, inside which I-glass is applied, has a value of 3…4°C higher compared to K glass and 7…10°C compared to ordinary glass.

The use of double-glazed windows with K-glass during the heating season provides energy savings of the order of 140 kW•h, and with the I-glass 230 kW•h from one square meter of the window surface compared to ordinary double-glazed windows.

One of the modern trends in creating energy-efficient translucent structures is the use of smart glass (dynamic glass). When installed in

low-emission glazed windows and filling the space between the gas windows, dynamic glass improves energy efficiency and also allows buildings to retain their appearance, optimize natural lighting and further reduce energy costs.

Smart glass is characterized by the ability to change optical properties (opacity (opalescence), transmittance, light absorption coefficient) when changing external conditions, such as illumination, temperature, or when power is applied. Different types of glass composites are based on photochromic phenomena associated with the change of transmittance properties under changing external conditions: change of light flux (photochromism), temperature (thermochromism), electrical voltage (electrochromism).

The benefits of smart glass are the reduction of heat losses, the reduction of air conditioning and room lighting costs; in a transparent state, liquid crystal or electrochemical glass does not pass UV rays.

Recent developments include photoelectric transparent glass units at quantum dots. Quantum dots absorb more solar energy than the most popular silicon semiconductor, they do not lose properties over time and are weather resistant. Using this method completely prevents harmful UV rays from entering the room and halves the amount of infrared radiation. This technology has created a product that produces electricity for homes using eco-friendly technology. The innovative product follows the trend of energy-saving construction and is suitable for passive homes.

The use of double-glazed windows with energy-saving coatings on windows not only helps to reduce heat losses through light-transparent structures, which make up about 40% of all heat losses of a building, but also helps to save energy resources for heating and air-conditioning of the room. The economic effect is manifested mainly in the reduction of heat emission through the translucent structure and the ability of the structure to block the passage of thermal radiation from heating devices through windows from the middle of the room into the environment, thereby reducing the heat consumption during the heating season. Sunscreen on windows in double-glazed windows by reflecting heat from direct, reflected or scattered sun rays prevents the room from overheating in the summer months and helps to reduce the load on the air conditioning and help to create comfortable conditions in the room.