Protection of Window Glass from Acoustic Leakage

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Abstract – In a survey was presented an analysis of the most common glass samples on the Ukrainian market on their protection level against leakage of acoustic information. The glass samples were studied by means of roentgen analysis, and the impact of elemental composition of glass according to a laser beam reflection factor was defined.

Key words – acoustic leakage, laser microphone, glass, analyzer, acoustic information.

I. Introduction

Protection of acoustic information from possible leakage through its technical channels is one of the crucial issues of information security both in state and commercial structures. With the latest technological developments in the field of foreign intelligence the task of protecting confidential negotiations is very complicated and particularly important. The heads of security services in enterprises and organizations are concerned about the emergence of advanced and effective portable remote equipment – laser microphone. It can reproduce the language, sounds and acoustic noises when the laser probes windows or any other surfaces that can reflect the optical beam. Typically, these systems use lasers in infrared wavelengths invisible to the human eye (0.75–1.1 microns), and the confidential information can be accessed by gathering data from the reflected signal.

To prevent the laser microphone usage tight blinds on windows and special facilities are recommended, although it can cause some inconveniences.

Recently, a separate research area has been established to prevent laser microphone usage and information leakage respectively. The task is to develop a special reflective protective film for window glass, which can prevent to gather information with the help of an optical method.

The aim of the research is to investigate the level of protection from the optical gathering of information for window glass from different Ukrainian manufacturers.

II. Materials and methods of research

The most popular glass samples on the Ukrainian market were selected. Namely: Saint-Gobain Diamant [1], Proletariy (M14, M16) [2], Pinkilgton Optifloat [3], Euroglas Eurofloat [4], GuardianfloatGuard [5]. Investigation of the elemental glass structure was performed on the EXPERT roentgen analyzer.

The laser reflection coefficient of glass was considered as security parameter.

Reflection coefficient can be calculated by using the Eq. 1:

$$K_{ref} = \frac{P_{ref}}{P_{in}} \quad (1)$$

P_{in} – The solid-state laser capacity;

P_{ref} – The capacity of the reflected beam from the sample.

To measure the intensity of the reflected laser beam was developed an installation which operates according to the following optical scheme (Fig. 1).

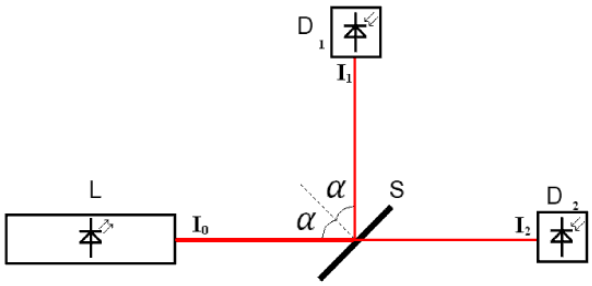

Fig. 1. Optical scheme of an installation:
L – Laser; S – sample; D1, D2 - detectors
(devices for measuring laser capacity).

To measure laser beam capacity using a laser power meter Pocket Laser Power Meter 840011 was used.

III. Experimental part

The results of the component-analysis of glass samples of the leading producers on the Ukrainian market acoording to their chemical composition, additives and corresponding mass concentrations presrnts in Table 1.

TABLE 1
THE COMPONENT-ANALYSIS OF GLASS SAMPLES

Manufacturer	Element	Mass fraction, %
Saint-Gobain	14Si 20Ca additives	54.189±0.292 41.257±0.218 4.554±0.584
Proletary	14Si 20Ca additives	54.434±0.307 40.096±0.231 5.470 ±1.076
Pinkilgton	14Si 20Ca additives	56.752±0.280 37.136±0.189 6.120±0.938
Euroglas	14Si 20Ca additives	55.058±0.301 38.454±0.215 6.488±1.032
Guardian	14Si 20Ca additives	57.349±0.280 37.108±0.185 5.543±0.745

As Table 1 shows the Euroglas samples contain the highest concentration of additives and Saint-Gobain samples the smallest.

Spectral analysis of chemical elements and their mass concentrations with an error of 0.01% from mass

fraction are presented on Fig. 2–3. As shown on Fig. 2 the amount of the main elements and impurities for all producers is almost identical and consists of a silicon (Si), and calcium (Ca).

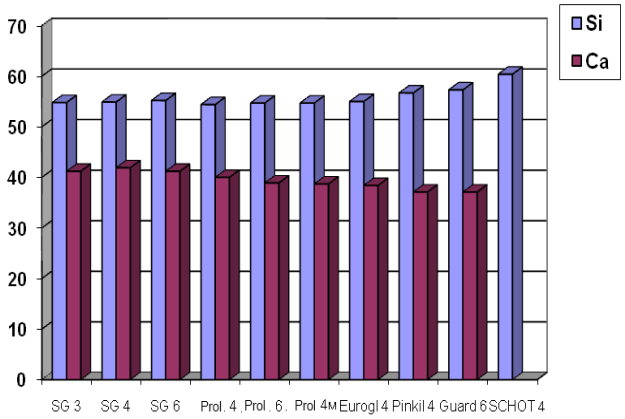

Fig. 2. The content of the main components in the glass samples

In the analysis of samples for impurities, it was discovered that the contents of elements such as Mg, Na, S, Fe, Ti in Saint-Gobain, Proletariat, Pinkilgton, Euroglas, and Guardian glass samples exceeds 0.1% (Fig. 3–5).

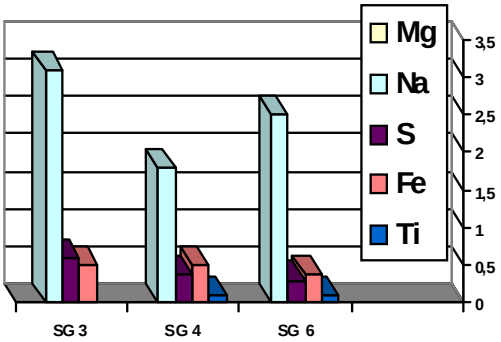

Fig. 3. The impurities content in the Saint-Gobain glass samples exceeds 0.1%

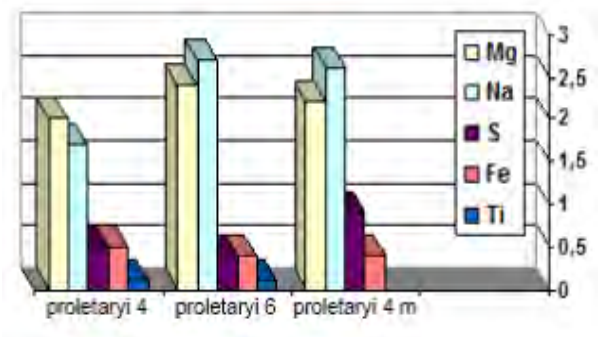

Fig. 4. The impurities content in the Proletaryi glass samples exceeds 0.1%

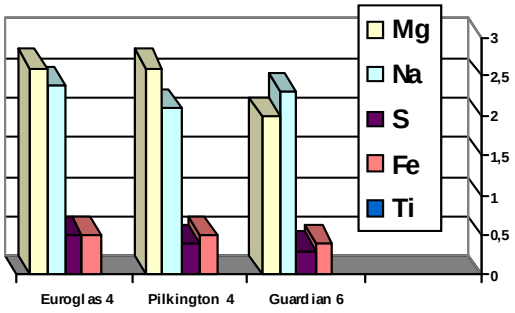

Fig. 5. The impurities content in the Euroglas, Pinkilgton, Guardian glass samples exceeds 0.1%

The reflection coefficients for the above studied glass samples are shown on Table 2.

TABLE 2

PROTECTIVE PROPERTIES OF GLASS SAMPLES

Manufacture	Thickness, mm	$P_{in.\ mW}$	$P_{ref.\ mW}$	$K_{ref.}$ %
SG	3	24,1	1,2	4,9
SG	4	24,2	1,43	5,9
SG	6	24,2	0,42	1,7
Proletaryi	4	24,02	0,68	2,8
Proletaryi	6	23,98	0,82	3,4
Euroglas	4	24,08	1,23	5,1
Pinkilgton	4	23,9	1,02	4,2

To protect the information from laser sensing the reflection coefficient has to be low. The best index has the glass of foreign manufacturer Saint-Gobain (6 mm), and Guardian (6mm). Their reflection coefficients equal 1.7 and 2.6 percent respectively.

Conclusion

Having studied the most common glass samples on the Ukrainian market on their level of protection against laser sensing and determining their composition, was discovered that the safest glass is Saint-Gobain (6mm) and Guardian (6 mm). Their reflection coefficients equal to 1.7% and 2.6% respectively due to the relatively low amount of Mg, Na, and other elements' impurities. Large glass thickness has positive effect on the information security.

References

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