Conclusion. The technologies and software tools listed above for developing a web application were chosen because they are proven, secure, and have extensive documentation. In particular, the Laravel web framework, in addition to having extensive documentation, also has access to a huge number of additional modules, which improves the quality of software and speeds up its creation. The database management system was chosen due to the fact that it is safe and easy to use.

The practical application of the considered web resource can be found as an additional functionality on sites for the promotion of goods and services related not only to the field of folk craft, but also in any companies organizing exhibitions and fairs. In addition, the successful practice of using such applications in the educational process in practical classes for students of both IT specialties [2–3] and specialties related to the management of any goods and services [3–4] is known.

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SPECTRAL ELLIPSOMETRY OF NICKEL OXIDE FILMS

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Keywords: spectral ellipsometry, optical constants, thin films, nickel oxide.

Nickel oxide (NiO) is used to create photovoltaic solar cells, which has unique optical and electrical properties, as well as good chemical stability. It is necessary to develop technological regimes for obtaining thin NiO films with optimal characteristics for their use in photovoltaics. The optical characteristics of the films (the refractive indices n(λ) and absorption k(λ)), determined by the method of spectral ellipsometry, are studied. The spectra tgΨ(λ) and cosΔ(λ) were measured on an ES-2 spectral ellipsometer [1] of the studied nickel oxide films on silicon and glass substrates at radiation incidence angles of 75°, 70°, 65°, and 60° in the spectral range – 400–1000 nm zone.

Material and methods. In order to determine the dispersion of the refractive indices $n(\lambda)$ and absorption $k(\lambda)$ of the films under study, an algorithm was developed for solving the inverse problem of spectral ellipsometry for the model of a two-layer wedge on a semi-infinite substrate (Fig. 1).

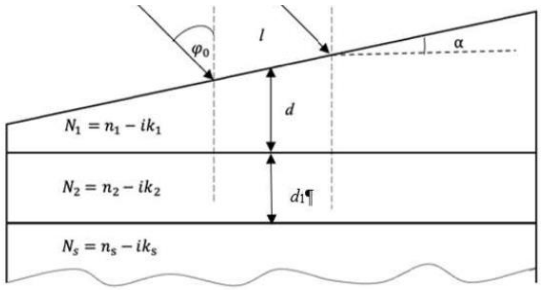

Figure 1 – Two-layer model of a wedge-shaped film on a semi-infinite substrate:
α – the angular thickness of the wedge, N_1, N_2 and N_3 – the complex refractive index of the film, transition layer and semi-infinite substrate, respectively;
φ_0 – angle of incidence of radiation.

The solution of the inverse problem of the spectral ellipsometry was obtained for the experimental spectra of polarization angles at 4 angles of incidence of radiation, while the dispersion of the optical characteristics of the substrates was given as known [2], the transition layer was described as binary by the Maxwell – Garnett model [3], and the dispersion optical characteristics of the layer were set by the simplified Sellmeier model [1]

$$n(\lambda)^2 = n_0^2 + \frac{1}{(1-\frac{\lambda_0^2}{\lambda^2})}, k(\lambda) = k_m e^{\frac{\lambda_m - \lambda}{\lambda_1}},$$

where n_0 – is the value of the refractive index at an infinite wavelength; λ_0 is the wavelength at which $n \rightarrow \infty$, λ_m = 550 nm; n_m – is the value of the refractive index at wavelength λ_m, k_m is the value of the absorption index k at wavelength λ_m, λ_1 is the wavelength interval at which k changes by a factor of e.

Results and its discussion. Analysis of the obtained solutions of the inverse problem of spectral ellipsometry showed the following. Firstly, thin films deposited on silicon substrates have a higher refractive index compared to films on glass substrates (Fig. 2).

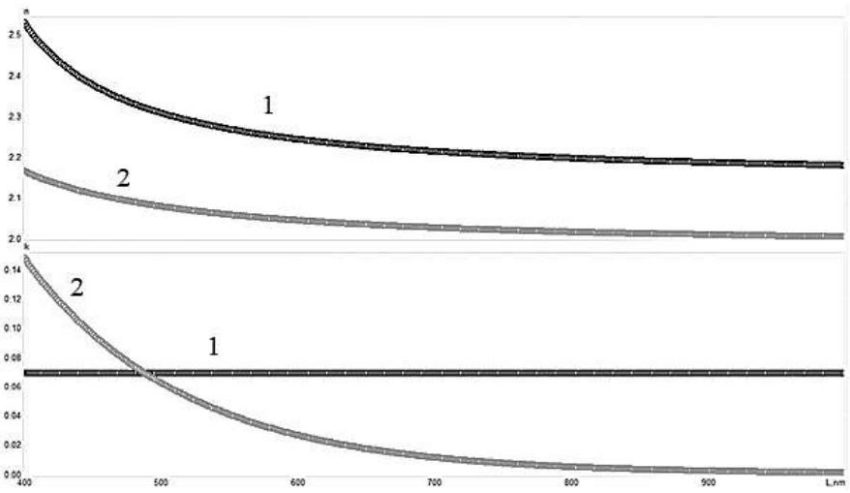

Figure 2 – Calculated dispersion dependences of the refractive indices $n(\lambda)$ and absorption $k(\lambda)$ of samples 1 and 2

Secondly, calculated refractive index spectrum of such films (Fig. 2, spectrum 2) is much lower than the analogous spectrum $n(\lambda)$ (Fig. 2, spectrum 1) of the stoichiometric NiO film, and the transparency of the NiO_x (x<1) film is much higher in the region $\lambda > 500$ nm.

Conclusion. To develop the optimal modes of high frequency magnetron sputtering of thin nickel oxide films used in photovoltaics, we analyzed the optical characteristics of a series of nickel oxide films deposited on silicon and glass substrates. It was found that the main factors influencing the dispersion of the refractive indices $n(\lambda)$ and absorption $k(\lambda)$ of NiO films are the substrate type. Films deposited on silicon substrates have the most optimal properties for use in photovoltaic cells.

The results of the study can be used to correct the conditions for the deposition of nickel oxide films on silicon and glass substrates by high frequency magnetron sputtering with optimal conditions for use in photovoltaics.

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ON THE MINIMAL DEFINITIONS OF QUASILOCAL FITTING CLASSES

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Keywords: σ-quasilocal Fitting classes, normal-hereditary H_{Q_σ}-function.

Throughout this paper, all groups are finite. In terminology and notation, we follow monograph [1]. In the theory of classes of finite group, the idea of localization is fundamental. A local method for studying finite solvable groups using radicals and Fitting classes was proposed by Hartley [2].

The idea of Hartley localization consists of study group classes in terms of p-groups and radicals defined by mapping (local H-functions or Hartley functions) of the set of all primes $\mathbb{P}$ into sets of Fitting classes.

The σ-method for studying local formation of groups was proposed and the concept of a σ-local formation was introduced in the series of works by Skiba A.N. [3–5]. The method was dualized in the theory of Fitting classes by Vorob'ev N.T. [6].

A natural problem is to generalize the definition of a σ-local Fitting class and its properties obtained in [6]. In particular, the result of Vorob'ev N.T. and Zagurski V.N. on quasilocal Fitting classes, defining the notion of σ-quasilocal Fitting class.

The main goal of this work is to generalize the notion of σ-local Fitting classes and to study the structural properties of generalized quasilocal Fitting classes.

Material and methods. In this paper, localization methods are used in the study of Fitting classes. In particular, methods of the theory of local Fitting classes.