

DEVELOPMENT OF A GRAPH MODEL OF THE RELATIONSHIP BETWEEN THE PARAMETERS OF THE SYNTHESIS OF TRANSPARENT CONDUCTIVE COATINGS AND PROPERTIES OF OXIDE COATING*

T.O. ZINCHENKO, E.A. PECHERSKAYA., D.V. ARTAMONOV, V.V. ANTIPENKO, S. A. GURIN, Y.V. SHEPELEVA¹

¹*Penza State University, Penza, Russia*

Depending on the treatment mode, the spray pyrolysis process allows to obtain various types of powders: magnetic powders of hexaferrite, TiO_2 , Al_2O_3 , SiO_2 [1-4], while the method is also actively used to produce thin films: transparent conductive oxides, absorbing coatings, protective, etc. Nevertheless, the widespread industrial introduction of spray pyrolysis is constrained by a large number of heterogeneous influencing factors [2], complicating the selection of the optimal technological regime, as well as imperfection of measuring equipment, which is used to control technological parameters during coating [3].

The whole set of factors influencing the properties and quality parameters of TCO coatings can be represented in the form of a directed graph (Figure 1 (a)). In this model, the vertices show the spray pyrolysis parameters, which can act as effects and reactions to these effects, arrows indicate the physical effects that describe the relationship of the parameters-reactions and parameters-effects.

Parameters-effects: T is pyrolysis temperature; χ is the impurity concentration; V is the solution volume; v is the spraying rate; P is the pressure in the sprayer; t is the spraying time; l is the distance between the substrate and the sprayer, ϵ is the dielectric constant of the material at high frequencies. Parameters - reactions: R - resistance, D - transmittance.

A number of parameters depend on other factors and, in turn, affect the process parameters. These parameters also act as effects and reactions: J, n, μ , Ef, d, Eg, L, ϵ_f , K, p, ρ , η , nk, c, ω , τ . The factors distribution in sets, depending on their influence on other parameters, is shown in Figure 1 (b).

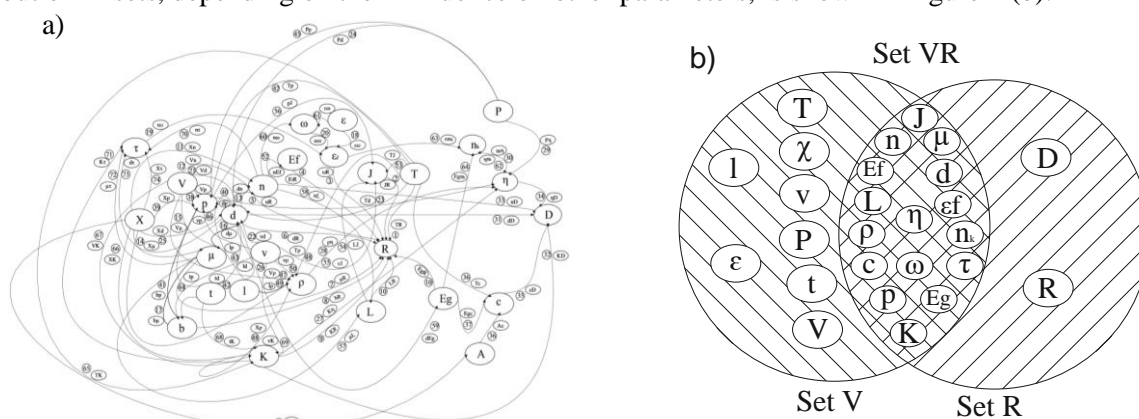


Fig. 1.a) A model of the relationship between the parameters of the synthesis of TCO and the properties of oxide coatings in the form of an oriented graph b) Venn diagram.

The proposed model was used to establish optimal technological conditions for obtaining transparent conductive coatings with desired properties.

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