



*Образовательные информационные технологии  
и робототехника*

*Educational information technologies  
and robotics*

## **ОБРАЗОВАТЕЛЬНЫЕ ИНФОРМАЦИОННЫЕ ТЕХНОЛОГИИ И РОБОТОТЕХНИКА**

**Материалы  
Республиканской  
научно-практической  
интернет-конференции  
с международным участием**

**27–28 марта 2018 года**



## **EDUCATIONAL INFORMATION TECHNOLOGIES AND A ROBOTICS**

**Proceedings  
of the Republican scientific  
and practical Internet conference  
with the international  
participation**

**March 27–28, 2018**

*V.SOBOL<sup>1</sup>, B.KORZUN<sup>1,2</sup>, O.MAZURENKO<sup>3</sup>, CH.FEDORCOV<sup>1</sup>, I.PEREPECHKO<sup>1</sup>,  
O.BORDOVICH<sup>1</sup>, A.KIRILENKO<sup>4</sup>, T.BIZHIGITOV<sup>5</sup>, S.TOMAEV<sup>5</sup>,  
B.NUSHNIMBAEVA<sup>5</sup>, S.EGEMBERDIEVA<sup>5</sup>, A.NAURYZBAEV<sup>5</sup>*

<sup>1</sup>Belarusian State Pedagogical University, 18 Sovetskaya St., Minsk 220030, Belarus

<sup>2</sup>The City University of New York, BMCC, 199 Chambers St., New York, NY 10007, U.S.A.

<sup>3</sup>Belarusian Republican Foundation for Fundamental Research, 66 Nezavisimosti Ave., Minsk 220072, Belarus

<sup>4</sup>Belarusian State Academy of Aviation, 77 Uborevich St., Minsk 220077, Belarus

<sup>5</sup>Taraz State Pedagogical University, 62 Tole bi St., Taraz 080001, Kazakhstan

## **METHODICAL ASPECTS OF THE PRESENTATION OF THE THEME «INFRARED REFLECTION SPECTRA OF CONDENSED MATTER» ON THE EXAMPLE OF THE SOLID SOLUTIONS IN THE BI (GD) -FE-O AND BI (ND) -FE-O SYSTEMS**

---

The topics “Absorption spectra”, “Reflection spectra” are rather hardly perceived by students especially when the complex non-linear structures are discussed. Indeed, the lines associated with the absorption of radiation by free atoms and molecules, as well as the emission lines from such objects, are fairly easy to perceive. The sharpness of their observation and their interpretation can be made in the representation of the properties of single atoms and molecules of a gas where the interaction between atoms or molecules can be neglected. The application of the Bohr postulate for atoms or molecules of a rarefied gas means either the presence of the emission line or the extinction of a given spectral line. That is, backward pictures by the form of their realization. Condensed nontransparent media, due to their density, allow one to register portions of the spectrum with more or less absorption through the reflectivity of the medium in this region described by the refractive index. The refractive index, in accordance with the general canons of the behavior of the light dispersion, decreases with increasing frequency to the limiting unit. At the same time, in the region of absorption bands, where resonant phenomena occur with a strong transition of the field energy to the irradiated material, the phenomenon of anomalous light dispersion with an increase in the refractive index and reflection is realized. The report presents the resonant phenomena of the interaction of electromagnetic radiation in the infrared range with vibrational modes of complex materials by the example of the solid solutions in the Bi (Gd) -Fe-O and Bi (Nd) -Fe-O systems.

Reflection spectra (Figure) show the activation of the strength of optical oscillator with an initial insignificant change in the concentration of doping elements against the background of a general decrease in the refractive index in accordance with normal dispersi It is significant that when the absorption is increased at  $18 \mu\text{k}$ , the band's extremum shifts to the red side at first. According to the data of other investigators, an extremum at  $18 \mu\text{k}$  in undoped ferrites of bismuth is also observed, but it is sufficiently appreciable in magnitude (about 20 %) at liquid hydrogen temperature and, as the temperature increases, decreases and also weakly shifts to the red region.

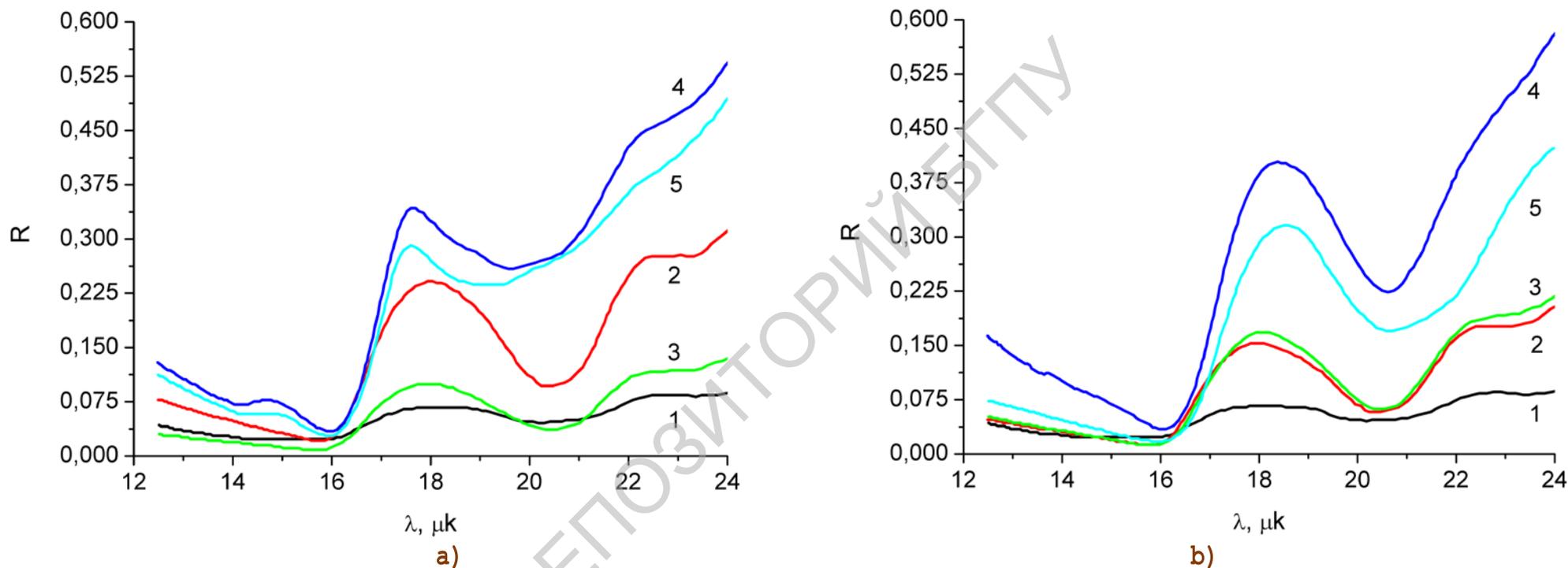


Figure - Reflection spectra of  $\text{Bi}_{1-x}\text{Nd}_x\text{FeO}_3$

(a, 1 -  $\text{BiFeO}_3$ ; 2 -  $\text{Nd}_{0,05}\text{Bi}_{0,95}\text{FeO}_3$ ; 3 -  $\text{Nd}_{0,1}\text{Bi}_{0,9}\text{FeO}_3$ ; 4 -  $\text{Nd}_{0,15}\text{Bi}_{0,85}\text{FeO}_3$ ; 5 -  $\text{Nd}_{0,2}\text{Bi}_{0,8}\text{FeO}_3$ ) and  $\text{Bi}_{1-x}\text{Gd}_x\text{FeO}_3$   
 (b, 1 -  $\text{BiFeO}_3$ ; 2 -  $\text{Gd}_{0,05}\text{Bi}_{0,95}\text{FeO}_3$ ; 3 -  $\text{Gd}_{0,1}\text{Bi}_{0,9}\text{FeO}_3$ ; 4 -  $\text{Gd}_{0,15}\text{Bi}_{0,85}\text{FeO}_3$ ; 5 -  $\text{Gd}_{0,2}\text{Bi}_{0,8}\text{FeO}_3$ ) at room temperature

In the present case, a somewhat opposite picture is observed: the reflection in the region of  $18 \mu\text{k}$  is initially small in comparison with but as the ions (Gd or Nd) are introduced it increases and reaches of about 40 % upon doping 20 at. %. As if both the decrease in the intensity of vibrations with decreasing temperature and the introduction into Bi sublattice of foreign elements leads to a similar effect of activation of oscillations with absorption. Reflection intensification with decreasing temperature is indicated also in, where for 295 K and 50 K the reflection coefficient is of the order of 37 % and 50 % respectively.