

obtain the quantitative description of the interplay between the domain kinetics and screening retardation. Also we analyze the possibility to observe the effect of frequency locking of domain motion. This effect occurs, when the oscillation frequency of the wall motion in ferroelectric capacitor becomes equal to the frequency of a small regular variation of the applied external voltage. It is shown that the frequency interval of the effect depends on amplitude of the alternating component of external voltage. We calculate the amplitude-frequency range of existence of the frequency locking effect.

*The research was made possible in part by the Ministry of Education and Science of the Russian Federation (UID RFMEFI59414X0011), by RFBR (Grant 13-02-01391-a) and by Government of the Russian Federation (Act 211, Agreement 02.A03.21.0006).*

1. Shur V.Ya., Rumyantsev E.L., *Ferroelectrics*, 151, 171 (1994)
2. Shur V.Ya., in *Nucleation Theory and Applications*, Schmelzer JWP, Weinheim, Wiley-VCH, 178 (2005)
3. Shur V.Ya., *J. Mater. Sci.*, 41, 199 (2006)
4. Eliseev E.A., Morozovska A.N. et al., *Phys. Rev. B.*, 78, 245409 (2008)

## **THE COLLINEAR GENERATION OF THE TERAHERTZ RADIATION IN PERIODICALLY POLED FERROELECTRIC MATERIALS**

Udalov A.R.

Ural Federal University, Yekaterinburg, Russia

E-mail: [art@labfer.usu.ru](mailto:art@labfer.usu.ru)

It was shown by theoretical analysis that the intensity of terahertz radiation generated in periodically poled ferroelectric materials with quasi-phase matching (QPM) is comparable with the intensity at optical frequencies.

It is known that the generation of the coherent terahertz (THz) radiation can be realized in periodically poled ferroelectric material with the domain structure period corresponding to quasi-phase matching [1-3].

The theoretical analysis of the multi-frequency collinear interactions ( $\omega_1$ ,  $\omega_2$ ,  $2\omega_1$ ,  $2\omega_2$ ,  $\omega_1+\omega_2$ ,  $\omega_2-\omega_1$ ) in quadratic-nonlinear crystal was performed. The obtained systems of equations describing the effects of generation waves in periodically poled ferroelectric material, energy transfer between the interacting waves, linear absorption and generation of backward waves was derived. The systems of nonlinear differential second-order equations and differential shortened (first-order) equations were compared.

Numerical calculations were performed with the parameters of lithium niobate crystal for generation terahertz radiation as difference-frequency [4-6]. A comparative analysis of the numerical solutions for obtained systems of equations demonstrated

that system of shortened equations neglects the important effect of backward wave generation. The efficiency of backward THz generation is the same as forward generation, but much narrower QPM range of periods.

1. Avetisyan Y., Sasaki Y. et al., Appl. Phys. B 73, 511 (2001)
2. Sasaki Y., Avetisyan Y. et al., Opt. Lett. 30, 21 (2005)
3. Sasaki Y., Yuri A. et al., Appl. Phys. Lett. 81, 18 (2002)
4. Takushima Y., Shin S.Y. et al., Opt. Expr. 15, 22 (2007)
5. Weiss C., Torosyan G. et al., Opt. Lett. 26, 8 (2001)
6. Jundt D.H., Opt. Lett. 22, 20 (1997)

## **ПРИМЕНЕНИЕ МЕТОДОВ ПРОГНОЗИРОВАНИЯ НАДЕЖНОСТИ ТЕХНИЧЕСКОГО ОБОРУДОВАНИЯ**

Акимова Е.В.<sup>1\*</sup>, Жаглина Е.Р.<sup>1</sup>, Акимов Д.А.<sup>2</sup>

<sup>1)</sup> Национальный минерально-сырьевой университет «Горный»,  
г. Санкт-Петербург, Россия

<sup>2)</sup> Компания КОМПЛИТ, Департамент программных решений,  
г. Санкт-Петербург, Россия

\*E-mail: [lena326@yandex.ru](mailto:lena326@yandex.ru)

## **THE APPLICATION OF METHODS FOR PREDICTING THE RELIABILITY OF TECHNICAL EQUIPMENT**

Akimova E. V.<sup>1\*</sup>, Gaglina E. R.<sup>1</sup>, Akimov D. A.<sup>2</sup>

<sup>1)</sup> National mineral resources University "Gorniy", Saint-Petersburg, Russia

<sup>2)</sup> Complete Company, Department software solutions, Saint-Petersburg, Russia

Annotation: considered one of the main issues of industrial production – forecasting of equipment failures. The methods used to solve this problem. Studies have shown high efficiency of application of neural networks.

Для непрерывной работы предприятия особенно важна надежность технического оборудования, поэтому совершенствованию, планированию и прогнозированию уделяется большое внимание. Следовательно, важно правильно отладить режимы активного состояния оборудования, работающие в реальном времени. Можно считать, что прогнозирование является чуть ли не основной целью и задачей большого числа специалистов, занимающихся анализом данных. Современные методы статистического прогнозирования позволяют с высокой точностью прогнозировать практически все возможные показатели.

При анализе временных рядов можно выделить две основные цели:

- определение природы временного ряда
- прогнозирование