VACUUM FLUORESCENT INDICATORS

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Abstract. Low-voltage cathodoluminescence serves as the physical basis for the operation of these devices, that is, their flash when bombarding a phosphor with slow electrons (up to 100 eV energy). In contrast to the widely used and well-studied high-voltage cathodoluminescence in ENT, in PKK electrons are inhibited and absorbed in a thin surface layer. There are several mechanisms of electron energy transfer to the crystal.

Key words. Other types of indicators, Screens, radiation spectra, radiation resistance, Vacuum heated indicators, portable displays, electrolytic and electrophoretic indicators, particle displacement, direct and alternating current.

ВАКУУМНО-ЛЮМИНЕСЦЕНТНЫЕ ИНДИКАТОРЫ

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Абстракт. Физической основой работы этих устройств служит низковольтная катодолюминесценция, то есть их вспышка при бомбардировке люминофора медленными электронами (энергией до 100 эВ). В отличие от широко используемой и хорошо изученной высоковольтной катодолюминесценции в ЛОР, в ПКК электроны тормозятся и поглощаются в тонком поверхностном слое. Существует несколько механизмов передачи энергии электронов кристаллу.

Ключевые слова. Другие типы индикаторов, Экраны, спектры излучения, радиационная стойкость, Индикаторы с вакуумным нагревом, портативные дисплеи, электролитические и электрофоретические индикаторы, смещение частиц, постоянный и переменный ток.

Vacuum luminescent indicators The physical basis of the operation of these devices is low-voltage cathodoluminescence, that is, their flash when bombarding a phosphor with slow electrons (up to 100 eV energy). In contrast to the widely used and well-studied high-voltage cathodoluminescence in ENT, in PKK electrons are inhibited and absorbed in a thin surface layer. There are several mechanisms of transfer of electron energy to the crystal: interaction with valence electrons and its transition to a higher level of the free zone (emergence of hot electrons), interaction with the crystal lattice and the appearance of elastic vibrations in the volume (volume plasmons) and surface plasmons. interaction of crystal lattice atoms with virtually no energy loss. Plasmons are not very long-lived (up to 10^{-5} s). Free electrons appear as a result of their stretching due to internal conversion. The threshold energy for plasmon generation is 10...20 V. Even less energy is required to excite valence electrons. Formed free charge carriers flow into the phosphor. Therefore, the recombination process is the same as in high-voltage cathodoluminescence (radiation spectra almost coincide). FIK also does not exceed 30%. the quantum yield of luminescence does not exceed 1 either. This means that for PVK to be effective, it is not possible to perform significantly high current density and high-speed scanning (copying) with an electron beam, as in ENTs.

Thus, the threshold voltage is 10 V; with the increase of the threshold, they increase proportionally to the current and voltage.

Advantage of VLI. The advantage of vacuum fluorescent indicators is their excellent ergonomic properties: high brightness. Eye-pleasing green flash, wide viewing angle. Lack of illumination in the pest, full compatibility with MDYA microcircuits in terms of current and voltage; the ability to prepare virtually any character locations; good usability, ability to work in extreme climatic conditions, technological convenience and cheapness based on the use of electrovacuum automated assembly lines and the absence of rare and expensive materials.

Other types of indicators. The considered liquid crystal, vacuum luminescent, semi-conductor devices form the basis of devices in the field of current, modern symbol synthesizing indicators, small format information synthesizing reflective systems. The huge industrial potential of each of these directions is a guarantee that this situation will be preserved for a long time. However, consumer requirements require the availability of other types of synthesizing indicators and new research in this area.

Gas discharge indicators. Gas discharge luminescence is used in gas discharge indicators. Devices of this class are based on simple elements forming a gas discharge space, which is filled with ordinary neon (yellow flash), sometimes helium (yellow flash), argon (violet), or other gases or their mixtures.

Two exchanges of energy are used: for example, UV-radiation in a xenon charge, acting on a photoluminophore, produces a flash in the field of vision. When the discharge is excited by direct current, dusting of the cathode material is observed, therefore, the perspective of working in alternating current is bright.
In practice, gas discharge BSQ is used in obsolete devices. In new devices, they were completely replaced by VLIs. But only the creation of large-format flat screens with gas discharge illumination reveals its possibilities in this field.

Another electrochromic effect is related to the oxidation-reduction process of organic compounds, such as fiologens. The electrodes in the fiologen cell are made of transition metal oxides, and the electrolyte between them can be solid (for example, lithium chlorate in an organic solvent), liquid (a mixture of acid with glycerol or glycol), brittle (based on sodium and aluminum oxide). can be When the voltage is applied (1...2 V), depending on the polarity between the electrodes, the electrode piece becomes colored or discolored. The distinctive advantages of EXIs are economic efficiency (low voltage and color charge), large viewing angle, wide operating temperature range (up to 150 ° C), and most importantly, the availability of memory: the data written when the consumption ends is years. can be stored during Their disadvantages include, first of all, the phenomenon of degradation (corrosion of electrochromic material). Also, the complexity of matrix (addressing) addressing due to the significant inertness of repainting and the non-threshold nature of reconnection. To some extent, EXI, electrolytic and electrophoretic indicators are similar; in the first one, when voltage is applied, galvanoplastic deposition of metal occurs at the cathode, which changes its return properties; in the second, charged pigmented (painted) particles move in the liquid under the influence of the field.

The need to replace ENTs with an optoelectronic counterpart appeared at the time of new requirements for displays and TV screens. The general appearance of these requirements is as follows. The screen has a flat panel design, which should ensure its original comfort and increase in size (up to 1...1.5 m) diagonally. Strictly speaking, the requirements for the transmission of volumetric images are not being discussed, but the implementation of these requirements with the involvement of holography will take a lot of time. At the same time, it was found that the feeling of volume gives the phenomenon of presence provided by a large format screen. The next requirement for television is the requirement to increase the resolution - to increase the number of elements to 1.5*106 (1200x1200). This automatically increases the frequency of the scanning current to several megahertz, making appropriate changes to the control circuits used in the optoelectronic display. The large format screen should be in the form of a matrix of character areas. At the same time, the required speed should be provided throughout the area. The requirement to be colorful is also important R-G-B color generation).

Compatibility of the large screen raster with microelectronic control devices is important: low voltage and small excitation current, the possibility of multiplex mode, color raster with memory, volt-clear lighting threshold of the characteristic. An important aspect of the creation of screens with a large information capacity is the progress in the field of displays, which is connected with the "computerization" of all aspects of human activity. We would like to mention that the demands placed on displays by technology are better met than the demands placed on TV screens.

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