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NASA TECH BRIEF

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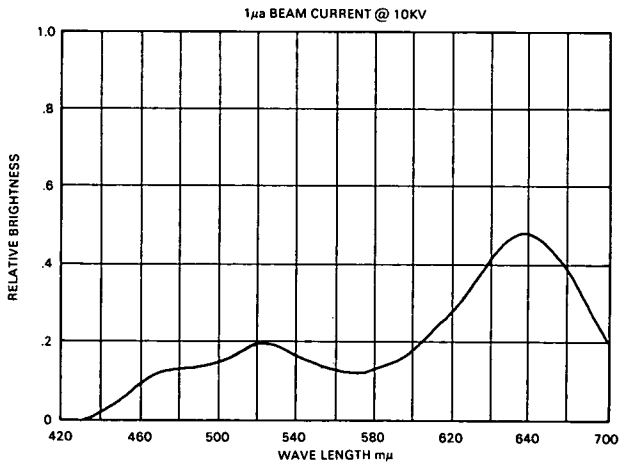
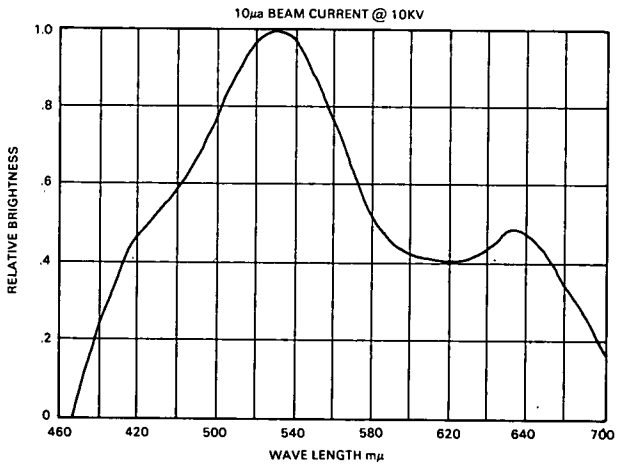
Luminescent Screen Composition for Cathode Ray Tubes





A screen composition for cathode ray tubes has been developed which exhibits differential color of emission as a function of beam current variation at a constant accelerating voltage. The screen consists of a mixture of phosphors which emit different hues, have different current saturation values and at least one of which exhibits a nonlinear current–brightness characteristic. At low beam current densities, the emission color of one of the phosphors predominates. As current density is increased, this phosphor reaches saturation, while the brightness of the second phosphor continues to increase so as to effectively mask the emission color of the first phosphor.

The lack of emission of this second phosphor at low current densities results from the intentional incorporation of poisoning elements such as nickel, and is particularly effective with ZnS:CdS systems. Thus, by mixing a nonlinear ZnS:CdS phosphor with any of a number of linear phosphors having limited activator content so that they will saturate at low current values, a number of color combinations become possible.

For example, a nonlinear sulfide green may be mixed with a linear red phosphor. When an electron beam of 1.0 microampere per square centimeter at 10 kilovolts is applied, the red will predominate. On the left figure it can be seen that there is relatively little green component and considerable red component, as evidenced by the peak in the 640 millimicron range. When the electron beam current is increased to 10 microamperes per sq cm at 10 kilovolts, the red phosphor saturates while the green component increases, as is evidenced in the right figure where there is now a peak in the 520–560 millimicron range, overpowering the 640 millimicron peak.

This arrangement is particularly useful when a display gradient is important, as an automatic alert, in which displayed values representing normal circumstances may be green. As conditions progress from

(continued overleaf)

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normal to abnormal, the beam current may be programmed to lower values so that the color rendition is modified to include overlapping color display, i.e., amber. Then, if circumstances become seriously abnormal, the beam current may be programmed to even lower values so that the red will now predominate, providing an immediate alert to the observer. Modulation may also be effected with other phosphor mixtures, so that red requires the higher beam current.

Notes:

1. This screen would also be useful in multiple gun tubes and would obviate the present requirement in such tubes of positioning dots of the three additive primary colors (red, green, and blue). Additionally, since no registration problems would occur, the spacing and diameter of the openings in the aperture mask could be made an order of magnitude closer and finer, respectively. In such a tube, by merely biasing the individual guns to different values, the resultant differential beam intensities would yield the appropriate colors wherever the individual beams impinged on the screen. Relative brightness of the primaries would be controlled by variation in duty cycle.
2. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Electronics Research Center
   575 Technology Square
   Cambridge, Massachusetts 02139
   Reference: B68-10056

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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(ERC-19)