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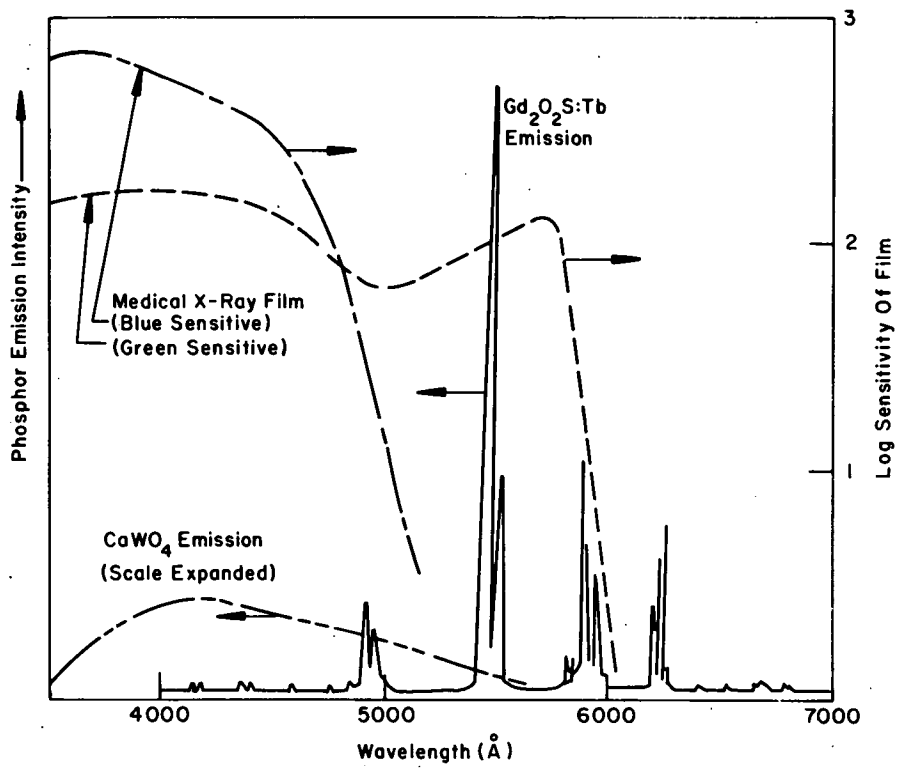
AEC-NASA TECH BRIEF

Improved Intensifying Screen Reduces X-Ray Exposure



Spectral Emission of $CaWO_4$ and Gd_2O_2S:Tb

A terbium-activated gadolinium oxysulfide (Gd_2O_2S:Tb) intensifying screen increases the sensitivity of x-ray film by a factor of 2 when compared to a standard calcium tungstate ($CaWO_4$) screen. Optimizing the film to this new x-ray phosphor can increase film sensitivity by a factor of 20. Consequently, x-ray exposure can be reduced comparably without changing the quality of present images.

Terbium-activated gadolinium oxysulfide has over five times the intrinsic luminescense efficiency of $CaWO_4$, with its emissions primarily in the green spectral range near 5400 Å. Calcium tungstate, on the other hand, emits a broadband which peaks in the blue spectral range near 4200 Å. The figure compares the two spectra; the $CaWO_4$ intensity scale is expanded for clarity.

(continued overleaf)

The spectral sensitivity of medical x-ray film (see figure) has developed over the years to match the blue emission from $CaWO_4$. The sensitivity range of this blue-sensitive film does not include the principle emission from Gd_2O_2S:Tb. There does exist, however, a green-sensitive film with the spectral sensitivity range shown. Using the green-sensitive film with a Gd_2O_2S:Tb screen, 1/18 of the x-ray exposure is needed to get film darkening equivalent to that obtained using a $CaWO_4$ screen. Using the blue-sensitive film with a Gd_2O_2S:Tb screen, 1/2 the exposure is needed for equivalent darkening. An even larger exposure reduction (about 1/20 of that presently required) will be possible when a new photographic film with maximum sensitivity near 5400 Å is developed for the new screens.

The new x-ray intensifying screen may make possible new radiographic procedures where detection speed and x-ray tube power have previously been the limiting factors. It will also significantly reduce the total population exposure to harmful radiation in the United States.

Note:

Requests for further information may be directed to:

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Reference: TSP72-10232

Patent status:

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