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Polarization of Radio-Photoluminescence of Fluoro-Dosimeter Glass

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After irradiation by ionizing radiation, fluoro-dosimeter glass emit fluorescent light by excitation with ultra-violet ray (radio-photoluminescence). By excitation with polarized ultra-violet ray, polarization of radio-photoluminescence of a fluoro-dosimeter glass was observed. Composition of the glass was $Al(PO_3)_3$ 50, $LiPO_3$ 50 and $AgPO_3$ 7 in weight ratio. Prisms of the glass ($8\times8\times4.7$ mm^3) with polished surfaces were irradiated by Co^{60} gamma ray for 2, 10, 30, 60, 120, 480 and 1440 minutes respectively with dose rate of 1.4×10^5 r/hr.

Experimental arrangements are shown in Fig. 1.

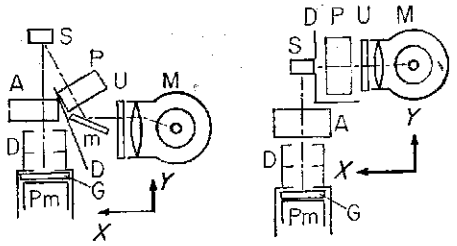

Fig. 1. Experimental arrangements M: mercury lamp, U: UV-D2 filter, P and A: polarizer and analyzer ("Dichrome"), D: diaphragms, m: mirror, S: glass samples, G: V-G1 filter, Pm: photomultiplier (Toshiba PM-50).

Samples were excited mainly by 365 mμ line of mercury.

Results are summarized in Fig. 2. The intensity ratio was plotted vs the irradiation time by gamma ray; namely, (Z axis is perpendicular to both X and Y. P and A represent directions of vibration of polarizer and analyzer resrectively, and E indicates direction of incidence of ultra-violet ray. Direction of observation is always parallel with Y. I is the observed intensity.)

1. $I_{A/\!/X}/I_{A/\!/Z}$ in cases $E/\!/X$ and $P/\!/Z$; full circles in (a).
   in cases $E/\!/X$ and $P/\!/Y$; in (b).
2. $I_{P/\!/Y}/I_{P/\!/Z}$ in cases $E/\!/X$ and $A/\!/Z$; in (c) (results of two series of measurements).
   in cased $E/\!/X$ and $A/\!/X$; in (d).
3. $I_{P\perp A}/I_{P/\!/A}$ in cases E was approximately parallel with Y; white circles in (a).

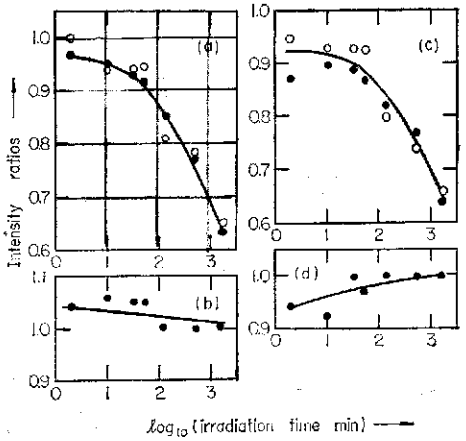

Fig. 2. Change of polarization of fluorescent light with irradiation time.

As is noted from the figures, polarization of fluorescent light became distinct with increase of irradiation time. Agglomeration of fluorescence centers or mutual interaction between them seems to be possible causes of this phenomenon.

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