CHARACTERISTICS OF SCINTILLATORS FOR BEAM MONITORS I. EMISSION SPECTRA OF DESMARQUEST AS TWO COLOR SCINTILLATION MONITOR IRRADIATED BY ION AND ELECTRON BEAMS

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Abstract

Desmarquest AF 995 R is very sensitive and radiation resistant scintillation monitor. It has very sharp visible emission band with long lifetime and broad ultraviolet emission band with short lifetime. It can be used for both continuous and pulse beam as two color scitillation monitor.

1.Introduction

Scintillators are often used for beam monitors. Desmarquest AF 995 R (High density sintered aluminum oxide including chromium oxide) is very high resistant scintillator for high energy ion and electron beam from accelerators. Desmarquest AF 995 R is used as beam monitors for electron and ion accelerators. Desmarquest AF 995 R shows red color during irradiation and the red color are usually monitored by TV cameras. However, the details of the scintillation characteristics of Desmarquest AF 995 R have not been studied yet.

Very high sensitive and space resolving beam monitors are useful for steady state irradiation and very high time resolution monitors are useful for pulse irradiation. Especially it is very convenient to accelerator operation and application that one monitor can be used for both steady state and pulse irradiation. Two color scintillation monitors have such possibility. Desmarquest is one of candidates for two color scitillation monitors.

Recently we have been studied the details of the scintillation characteristics of Desmarquest AF 995 R such as the emission spectra and lifetimes. The present paper mainly describes the emission spectra of Desmarquest AF 995 R, especially broad ultraviolet emission band with short lifetime in addition to the very sharp red emission band with long lifetime.

2.Experimental

Desmarquest AF 995 R is 99.5% Al_2O_3 containing chromium oxide.

Desmarquest in a vacuum chamber was irradiated with 1 MeV H^+ ions from a single-ended Van de Graaff accelerator of Research Center for Nuclear Science and Technology, University of Tokyo [1]. Emission spectra from Desmarquest were measured by a time resolving optical analyzer (OMA) with the wavelength region between 250 - 750 nm [2].

Desmarquest was also irradiated with electron beam from linear accelerator of Nuclear Engineering Research Laboratory, University of Tokyo[3]. Time resolved emission spectra were measured by both streak camera and photomultiplier[4]. Very

recently the systems were modified and time resolution is 10 ps for the streak camera system and 400 ps for photomultiplier[5].

3.Results and Discussion

Fig.1 shows emission spectra observed by optical multichannel analyzer (OMA) for Desmarquest AF 995 R irradiated with 1.0 MeV H^+ at room temperature in vacuum chamber. Desmarquest has two emission bands: broad ultraviolet emission band with short lifetime and sharp visible emission band with long lifetime. The red emission band has shoulder at shorter wavelength side.

The ultraviolet emission band was observed by electron pulse radiolysis system as shown in Fig.2. The lifetime of the ultraviolet band was measured by streak camera. The ultraviolet emission band decayed apparently within 10 ps electron pulse.

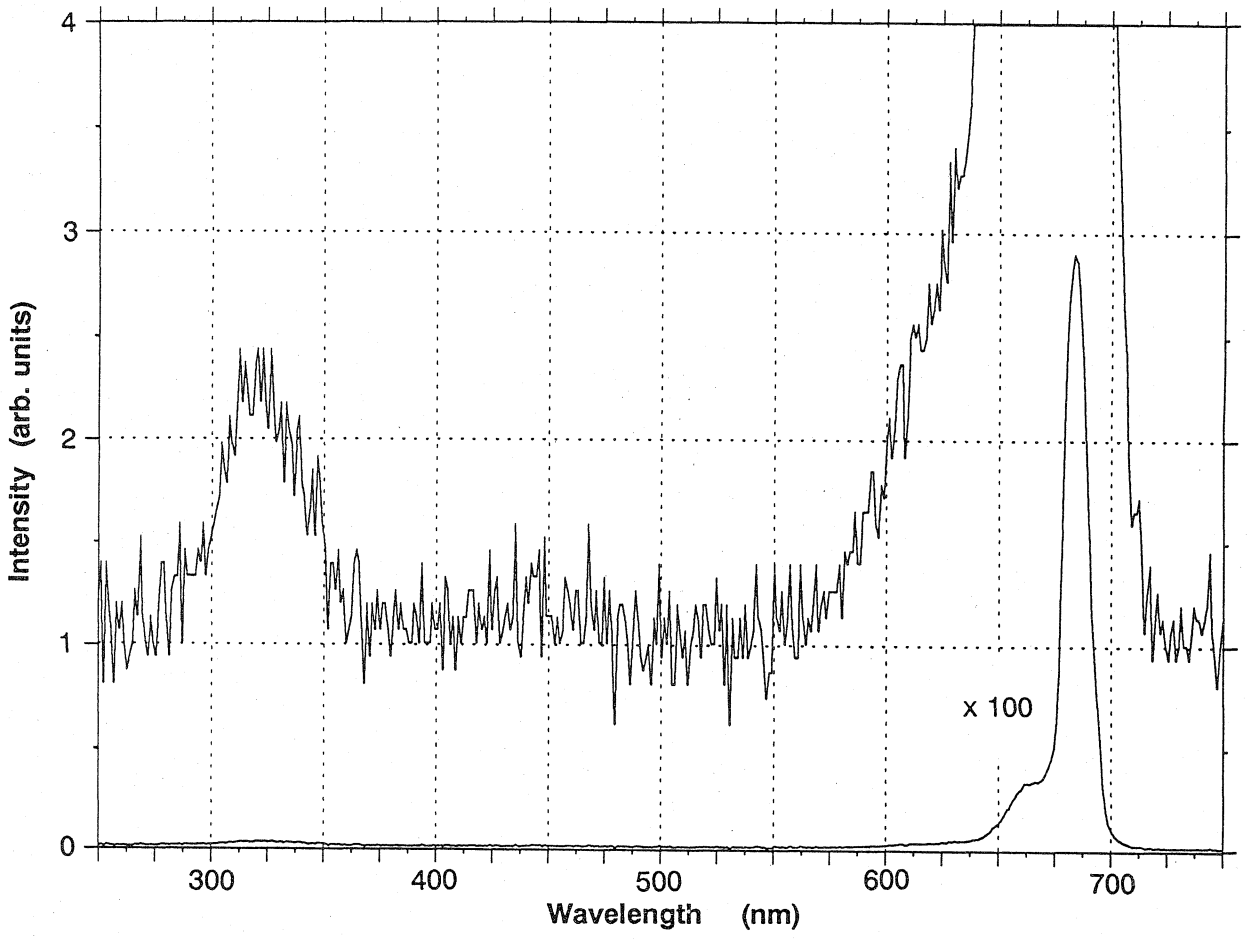

Fig.1 Emission spectra observed by optical multichannel analyzer (OMA) for Desmarquest AF 995 R irradiated with 1.0 MeV H^+ at room temperature in vacuum chamber. H^+ from a single-ended Van de Graaff accelerator.

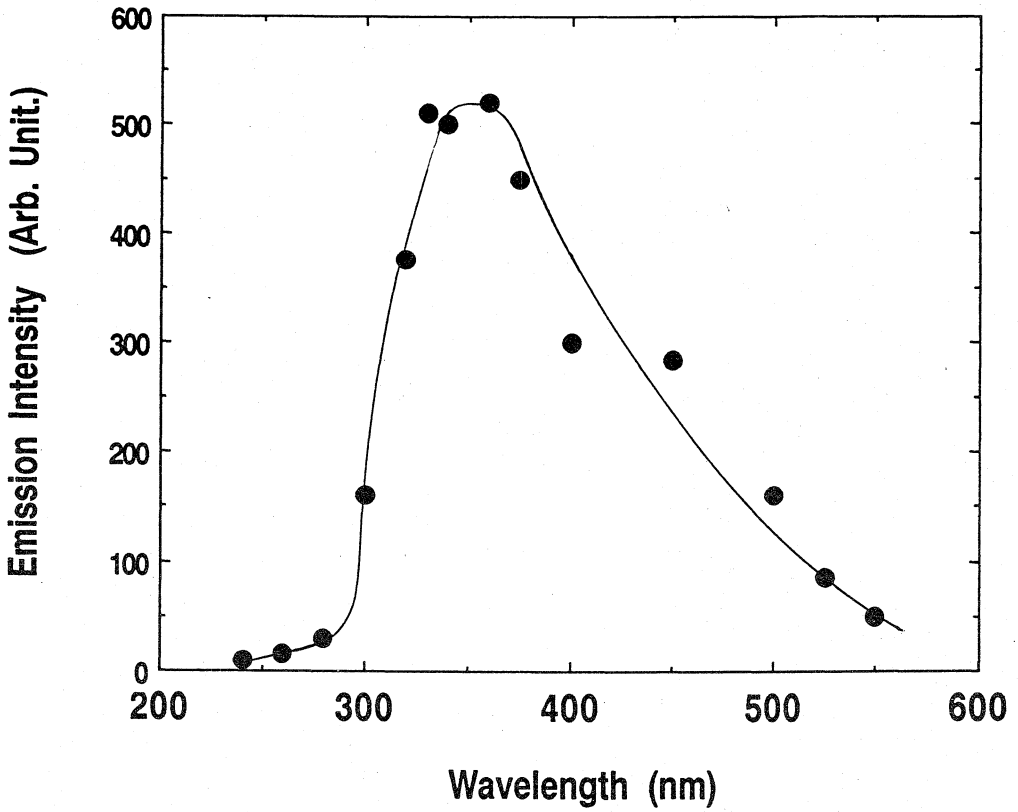

Fig.2 Emission spectra monitored during 10 ps electron pulse irradiation of Desmarquest AF 995 R at room temperature.

4.Conclusion

Desmarquest AF 995 R, which is the very sensitive and radiation resistant scintillation monitor, has very sharp visible emission band with long lifetime and broad ultraviolet emission band with short lifetime. The ultraviolet emission band decayed apparently within 10 ps electron pulse and useful for pulse monitoring. The visible emission band has red emission and long lifetime. The visible emission band are very useful for TV camera and eye. Desmarquest is one of candidates for both continuous and pulse beam as two color scitillation monitor.

References

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