TIME-RESOLVED PHOTOLUMINESCENCE OF Al_2O_3 IRRADIATED WITH 1.2 – 3 MeV/amu

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ABSTRACT

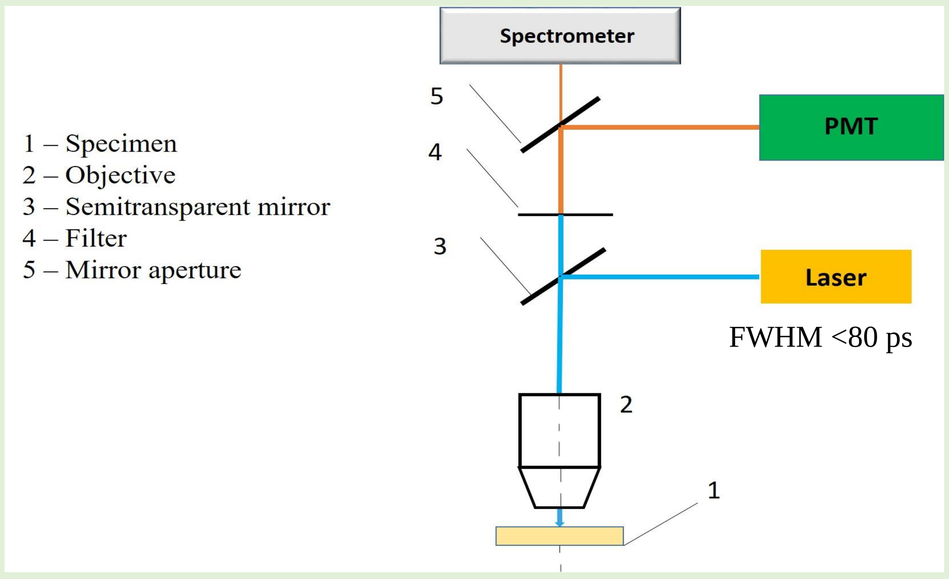
Time Correlated Single Photon Counting technique has been used to study the luminescence decay in Al_2O_3 irradiated with swift heavy ions. As was found, picosecond laser pulse excitation at 445 nm enhances broad overlapped emission bands ranging from 490 to 750 nm with lifetimes gradually increasing from τ = 7 ns (500 nm) to τ = 9 ns (640 nm). The nature of this luminescence is associated with radiative recombination of F_2^{2+}-centers and F_2^{2+}-centers + Cr impurity.

MOTIVATION

Monocrystalline corundum, α-Al_2O_3, is one of the most radiation-resistant dielectrics and may be used as an optical material and an electrical insulator for operation in radiation fields. The structural disorders in Al_2O_3 irradiated with neutrons, electrons, light and heavy ions with energies of tens and hundreds of keV and corresponding absorption and luminescence spectra have been investigated in detail [1]. High-energy heavy ion effect (E > 1 MeV/amu) is less studied, especially in the region of high levels of ionization energy losses.

EXPERIMENTAL

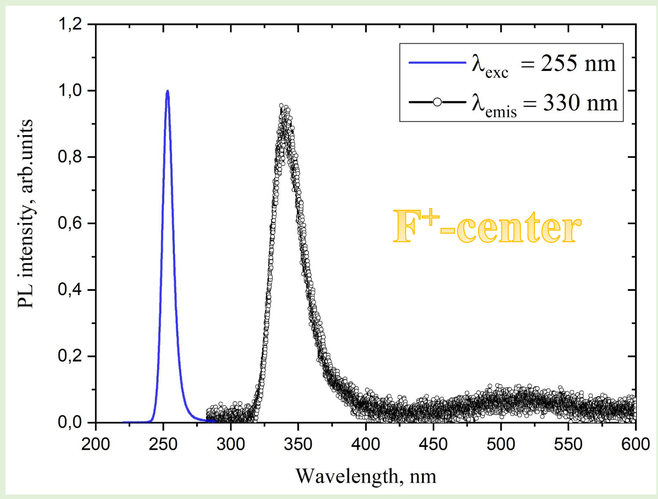
Single crystalline α-Al_2O_3 specimens were irradiated with **160 MeV Xe** and **710 MeV Bi** ions in the fluence range from 10^{10} to 2×10^{13} cm^{-2} at the cyclotron complex FLNR in Dubna.

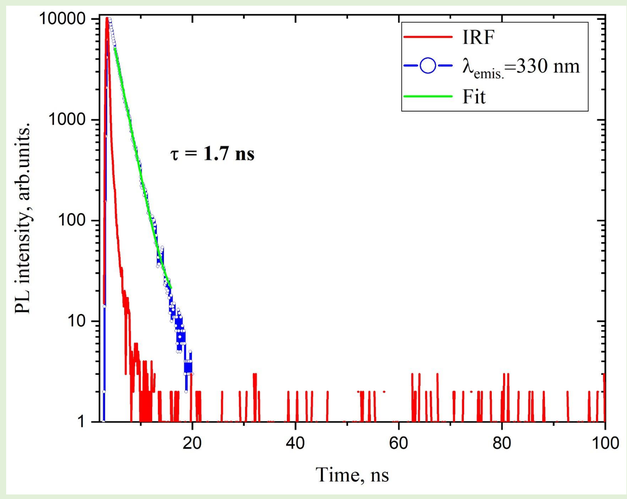


a) b)

Fig. 1. Block diagram for photoluminescence measurement (a) and photo of the setup (b)

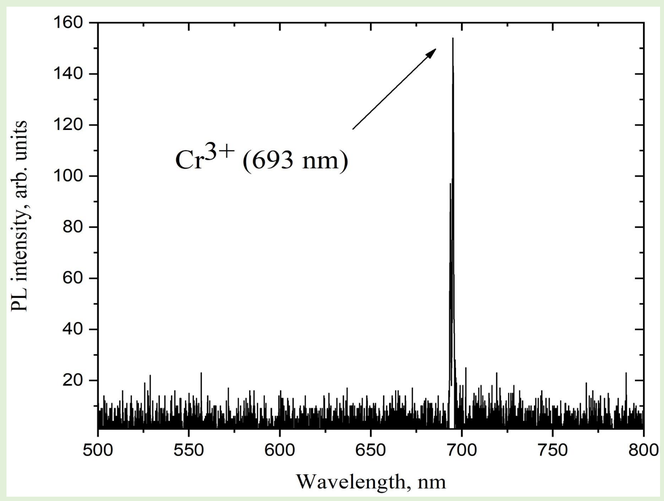
RESULTS

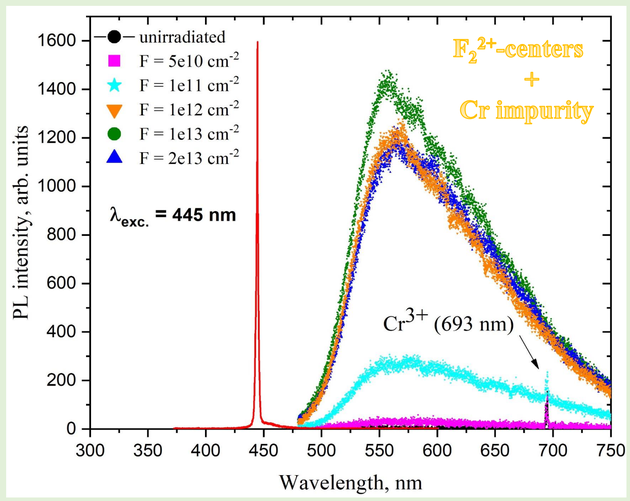




a) b)

Fig. 2. Spectrum (a) and kinetics of luminescence (b) of Al_2O_3 irradiated with 160 MeV Xe ions. IRF – Instrumental Response Function





a) b)

Fig. 3. Photoluminescence spectrum of intact Al_2O_3 (a) and dependence of the photoluminescence spectra on Bi ion fluence (b)

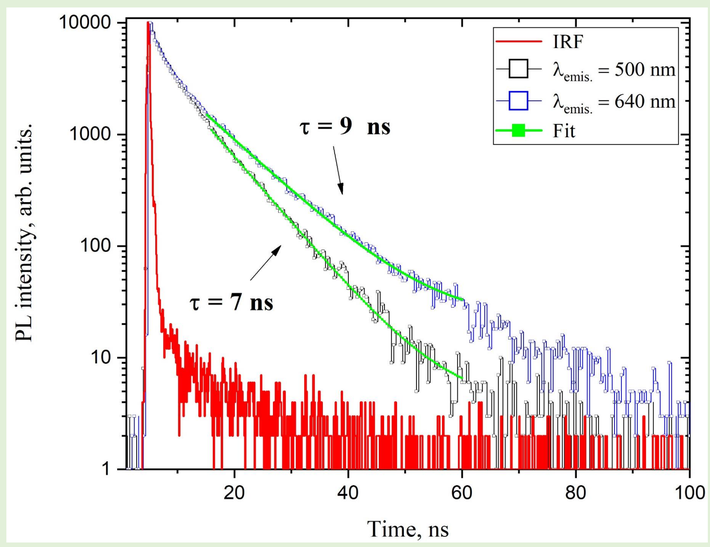


Fig. 4. Photoluminescence decay curves at the wavelength of 500 – 750 nm and ion fluence 2×10^{13} cm^{-2}

REFERENCES

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