Scintillation response of gallium oxide to charged particle and gamma radiation

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We have measured the response of the wide band gap scintillator Ga_2O_3 doped with both Sn and Fe to a variety of beta particle emitting sources such as: ^{14}C, $^{90}Sr/Y$, ^{137}Cs to assess its use as a beta spectrometer, reproducing energy spectra from these sources in relative agreement with spectra calculated using the IAEA radioisotope nuclide chart and Betashape model. Various filters, both inorganic and organic, were placed between the sources and the scintillator/PMT system in order to obtain information regarding the absorption of betas in thin filter materials for specific β^- emissions. To our knowledge, past measurements have only measured total energy losses for the β^{-s} and compared to calculated values as tabulated on the NIST e-STAR data base. More detailed data regarding beta energy absorption as a function of energy and depth in organic materials could be valuable in the area of beta-source radiation therapy using beta sources. Additionally, such data could advance our interpretation of spectra obtained in environmental contamination situations where a β^- sources may be located beneath a absorbing material, distorting the β^-spectroscopic results. Although the scintillation response of Ga_2O_3 to gamma radiation is low, we have also measured Compton electron distributions in various Ga_2O_3 samples using both gamma emitting radioisotopes and accelerator-generated gamma rays. Finally, energetic ion beams of hydrogen and helium were directed onto Ga_2O_3 to assess its use as a spectrometer or energy converter, which could have relevance for space applications or radioisotopic power sources.