

## RADIATION DETECTOR DEVELOPMENTS IN MEDICAL APPLICATIONS

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In recent years a number of new gamma-ray scintillators has become commercially available. These new materials were either derived from earlier known scintillators, e.g.  $\text{Lu}_{1-x}\text{Y}_x\text{AlO}_3:\text{Ce}$  (LuYAP) from  $\text{LuAlO}_3:\text{Ce}$  and  $\text{Lu}_{2(1-x)}\text{Y}_{2x}\text{SiO}_5:\text{Ce}$  (LYSO) from  $\text{Lu}_2\text{SiO}_5:\text{Ce}$ , or are the result of new discoveries, such as  $\text{LaCl}_3:\text{Ce}$  and  $\text{LaBr}_3:\text{Ce}$ . The first two materials are primarily of interest because of the relatively high detection efficiency and fast response; LYSO has found application in time-of-flight positron emission tomography (TOF PET) and the LuYAP-LYSO combination in small animal PET. The halide scintillators show a for scintillators unprecedented good energy resolution of ~3% at 662 keV and they have a relatively high light yield.  $\text{LaBr}_3:\text{Ce}$  is being studied for application in TOF PET. At the same time the search for and research on new scintillator materials is going on. For example  $\text{LuI}_3:\text{Ce}$  is a new material with a very high light yield (~90,000 photons per MeV to be compared with 40,000 photons per MeV for  $\text{NaI}:\text{Tl}$ ). Other examples of new materials are  $(\text{C}_6\text{H}_{13}\text{NH}_3)_2\text{PbI}_4$  and  $(\text{C}_3\text{H}_7\text{NH}_3)_2\text{PbBr}_4$ , organic-inorganic hybrid compounds of which the former has a very fast sub-nanosecond response.

For position-sensitive scintillation light detection, in addition to position-sensitive photomultiplier tubes (PS-PMT), pixelated avalanche photodiodes (APD) are drawing increasingly attention. For a very fast response, the micro-channel plate PMT (MCP-PMT), the hybrid photodetector with APD (HAPD) and the silicon PMT (SiPMT) are very interesting devices. The new scintillators and light sensors show great promise for new developments in medical applications, in particular for PET systems. A review will be presented.

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