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Design, fabrication and performance optimization of bi-polar blocking planar HPGe radiation detector[1] MUHAMMAD KHIZAR, GUO-JIAN WANG, DONGMING MEI, University of South Dakota, South Dakota, USA — A prototype planar radiation detector is designed, fabricated and characterized using bi-polar contact deposited on high purity single crystal germanium (HPGe). Performances of planar and semi-planar detectors are carried out for their low background counting and high absolute efficiency for high-energy photons applications. For this study, 40mm ? 15mm (diameter to vertical height) p-type HPGe samples with dislocation density EPD <3000 cm-2 are taken from HPGe ingots grown by Czochralski method. After a successful mechanical preparation, and standard cleaning and polishing procedure, samples are chemically etched by using a mixture of highly concentrated acids HF:HNO3 (1:4) in order to remove the surface oxides. A bi-polar blocking layer of amorphous germanium (a-Ge) is deposited on both the samples using low temperature RF sputtering plasma in a pre-mix precursor of H2 (15%) and Ar. For this, an optimized dose of the plasma power and chamber pressure is used for a controlled low temperature. The process was completed with the evaporation of Ohmic contacts using electron beam evaporator. This is worth noticing that special care is introduced during the handling of these samples, especially for the bi-polar blocking and metal contact layers deposition. Finally, the fabricated detectors are characterized at 77K temperature. In this paper, we show the results from the first prototype detector made of home grown crystals at USD.

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