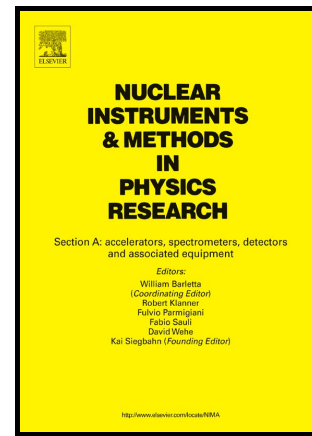


Author's Accepted Manuscript

Neutron Detection Performance of Silicon Carbide and Diamond Detectors with Incomplete Charge Collection Properties

M. Hodgson, A. Lohstroh, P. Sellin, D. Thomas



www.elsevier.com/locate/nima

PII: S0168-9002(16)31135-4
DOI: <http://dx.doi.org/10.1016/j.nima.2016.11.006>
Reference: NIMA59425

To appear in: *Nuclear Inst. and Methods in Physics Research, A*

Received date: 11 September 2016
Revised date: 5 November 2016
Accepted date: 6 November 2016

Cite this article as: M. Hodgson, A. Lohstroh, P. Sellin and D. Thomas, Neutron Detection Performance of Silicon Carbide and Diamond Detectors with Incomplete Charge Collection Properties, *Nuclear Inst. and Methods in Physics Research, A*, <http://dx.doi.org/10.1016/j.nima.2016.11.006>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and a review of the resulting galley proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Neutron Detection Performance of Silicon Carbide and Diamond Detectors with Incomplete Charge Collection Properties[☆].

M. Hodgson^{a,*}, A. Lohstroh^a, P. Sellin^a, D. Thomas^b

^a*Department of Physics, University of Surrey, Guildford, GU2 7XH, United Kingdom*

^b*NPL[©], Teddington, TW11 0LW, United Kingdom*

Abstract

The benefits of neutron detection and spectroscopy with carbon based, wide band gap, semiconductor detectors has previously been discussed within literature. However, at the time of writing there are still limitations with these detectors related to availability, cost, size and perceived quality. This study demonstrates that lower quality materials - indicated by lower charge collection efficiency (CCE), poor resolution and polarisation effect - available at wafer scale and lower cost, can fulfil requirements for fast neutron detection and spectroscopy for fluxes over several orders of magnitude, where only coarse energy discrimination is required.

In this study, a single crystal diamond detector (D-SC, with 100% CCE), a polycrystalline diamond (D-PC, with $\approx 4\%$ CCE) and semi-insulating silicon carbide (SiC-SI, with $\approx 35\%$ CCE) have been compared for alpha and fast neutron performance.

All detectors demonstrated alpha induced polarisation effects in the form of a change of both energy peak position and count rate with irradiation time. Despite these operational issues the ability to detect fast neutrons and distinguish neutron energies was observed.

This performance was demonstrated over a wide dynamic range (500 - 40,000 neutrons/s), with neutron induced polarisation being demonstrated in D-PC and SiC-SI at high fluxes.

[☆]©British Crown Owned Copyright 2016/AWE.

*Corresponding author

Email address: michael.hodgson@becq.co.uk (M. Hodgson)

Download English Version:

<https://daneshyari.com/en/article/5493303>

Download Persian Version:

<https://daneshyari.com/article/5493303>

[Daneshyari.com](https://daneshyari.com)