Introduction to Charged-Particle Detectors

ORTEC Charged-Particle Detector Data Summary and Selection Chart

Series	Chief Application	Starting Material	Range of Active Area (mm^2)	Range of Active Thickness (µm)	Warranted Operating Temperature Range*	Diode Structure	Nominal Structure** Stopping Power of Wndows	
							Entrance	Exit
ULTRA†	High-resolution, high-efficiency alpha and beta spectroscopy	Si	25–3000	100–500	+60°C to –196°C (LN_2)	Implanted Boron — N-type Si Implanted As Partial Depletion	500 Å Si	
ULTRA AS†	Ultra-low background high-efficiency alpha spectroscopy	Si	300–1200	100	+60°C to –196°C (LN_2)	Implanted Boron — N-type Si Implanted As Partial Depletion	500 Å Si	
ULTRA CAM†	Alpha and beta continuous air monitoring (counting in adverse environment)	Si	300–2000	100 (Deeper detector requires special order)	+60°C to –196°C	Implanted Boron — N-type Si Implanted As Partial Depletion	N/A	
A	High-Resolution charged-particle spectroscopy (Nuclear Physics and Chemistry-Space Physics)	Si	25–450	1000–2000	+25°C to –30°C‡	Gold — N-type Si Aluminum Partial Depletion	800 Å Si	
B	Particle identification, telescopes of detectors (Nuclear Physics and Chemistry-Space Physics)	Si	50–450	150–2000	+25°C to –30°C‡	Gold — N-type Si Aluminum Total Depletion	800 Å Si	2250 Å Si
C	Backscattering from a collimated source or beam target-angular correlation measurements (Nuclear Physics)	Si	50–450	100–1000	25°C to –30°C‡	Gold — N-type Si Aluminum Partial Depletion	800 Å Si	2250 Å Si
D	Time-of-flight measurements with heavy ions (Nuclear Physics)	Si	10–450	15–100	10°C to 25°C	Gold — N-type Si Aluminum Total Depletion Planar	800 Å Si	2250 Å Si
F	Heavy-ion spectroscopy (Nuclear Physics)	Si	100–900	≥60	+25°C to –30°C‡	Gold — N-type Si Aluminum Partial Depletion High Field Strength	800 Å Si	
L	Medium-energy proton (25 MeV) and other charged-particle energy spectroscopy	Si (Lithium compensated)	25–200	5000	+25°C to –196°C (LN_2)	Gold — Lithium Compensated P-type Si Lithium (diffused)	2000 Å Si	
R	Charged-particle spectroscopy operable in air and ambient light	Si	50–2000	100–500	+25°C to –30°C‡	Aluminum — P-type Si Gold Partial Depletion	2300 Å Si	
Beta-X§	High-resolution beta spectroscopy	Si (Lithium compensated)	80	5000	–196°C (LN_2)	Gold — Lithium Compensated — P-type Si Lithium (diffused)	2000 Å Si	

** Measured with 5.486-MeV natural alpha particles.
† ULTRA series detectors are manufactured by ion-implantation silicon-dioxide passivated technologies. Versions bakeable at 200°C available on special order.
‡ Available with special cryogenic mount capable of cycling down to LN_2 temperature.
§ The Beta-X detector is offered in a sealed cryostat.

[1]M. Martini, T.A. McMath, I.L. Fowler, "The Effects of Operating Temperature on the Behavior of Semiconductor Detectors," *IEEE Trans. on Nucl. Sci.*, Vol. NS-17, No. 3, pp. 139–148 (1970).

[2]C. Canali, M. Martini, G. Ottaviani, A. Alberigi-Quaranta, "Measurement of the Average Energy per Electron-Hole Pair Generation in Silicon between 5 and 320 K," *IEEE Trans. on Nucl. Sci.*, Vol. NS-19, N4, pp. 9–19 (1972).

[3]*Radiation Detection and Measurement* (2nd Edition) by Glenn F. Knoll, New York: John Wiley and Sons, 1989, and *Semiconductor Detectors*, edited by G. Bertolini and A. Coche, North Holland Publishing Co., 1968 (distributed in the U.S. by American Elsevier Publishing Co.), New York City.

[4]F.S. Goulding and R.H. Pehl, "Semiconductor Detectors," Section IIIA, *Nuclear Spectroscopy and Reactions*, J. Cerny, Ed. Academic Press (1974).

Specifications subject to change
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