Development of radon detector for atmosphere

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An increase of the radon in underground water at Nishinomiya City[1] and an increase of the radon in atmosphere[2] at the southern part of Hyogo Prefecture earthquake in 1995 were reported. Moreover, in the case of Tohoku Region Pacific Coast Earthquake, the data of the exhaust air monitor in the radiation facility of Fukushima Medical College (Fukushima) has been reported that the peak duration was long, and the peak decreased rapidly before the earthquake[3].
We had measured radon concentration in a pit of Kurashiki mine, and in the atmosphere in Chiba Prefecture, Chiba. We used a Radon Monitor of SUN NUCLEAR Corporation, Model 1028 in the Kurashiki, and Pylon Trace Environmental Level Radon Gas Detectors (abbreviated to TEL) in Chiba. The TEL is composed of ZnS(Ag) scintillator and a Photomultiplier. Its output spectra have continuous distribution. Then counts depend on discrimination level, and have sometimes shift of background counts. On the other hand PIN photodiode have been developed for high sensitive radon detector, and used in Super-Kamiokande[4]. This time we produced a usual detector of atmospheric radon, using PIN photodiode.
We use a Si PIN photodiode, S3204-09 (Unsealed), supplied by Hamamatsu Photonics K.K. We constructed a radon detection system, using a stainless pot as air container, H4083 as charge amplifier, C4900-01 as High voltage power supply module, 4419 (CLEAR-PULSE) as Pulse shape amplifier, MCA-Lite (Laboratory Equipment Corporation) as Multi Channel Analyzer and a Personal computer as data analysis. Output of the multi-channel analyzer showed clear alpha peaks of ^{218}Po and ^{214}Po of radon daughters from Uranite. However, the Si PIN photodiode showed peak large shift. It were overcome by coating surface of white ceramic with carbon tape. We introduced atmosphere to the PIN photodiode, using air pomp, flowmeter and silica gel for dehumidification. It showed same peaks of radon daughters, and we observed daily alteration of their intensity.
References
1) Igarashi G., Saeki T., Takahata N., Sano Y., Sumikawa K., Tasaka S., Sasaki Y. and Takahashi M.: Groundwater radon anomaly before the Kobe earthquake, *Science*, 269, 60-61, 1995
2) Yasuoka, Y. and Shinogi, M.: Anomaly in atmospheric radon concentration: a possible precursor of the 1995 Kobe, Japan, earthquake. *Health Physics*, 72, 759-761, 1997
3) Nagahama H., Yasuoka Y., Suzuki T., and Homma Y.: Radon Variation in the Air Before the 2011 Tohoku Earthquake (Mw =9.0), Programme and Abstracts, A32-09, The Seismological Society of Japan. 2011, Fall Meeting.
4) Nemoto, M., Tasaka S., Hori H., Okumura K., Kajita T., and Takeuchi Y. : Development of High Sensitive Radon Detector with Electrostatic Collection. *Radioisotopes*, 46, 710-719, 1997 (Japanese)

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