Development Of An Innovative Radiation Detector For Marine Use

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Student Presentaton

SUMMARY
During sea transportation, radioactive materials are stored in radiation-shield containers. Radiation leakage from such containers is continuously monitored with conventional radiation detectors. However, extreme conditions encountered at sea, for example, ship movements, high or low temperatures, and salt in the air can damage onboard detectors. Thus, development of more stable radiation detectors is essential for safe sea transportation of radioactive materials.

Currently, I am developing a new radiation detector using radiation induced surface activation (RISA). This phenomenon was first discovered by our research team at Tokyo University of Marine Science and Technology. When radioactive rays are irradiated against oxidized metal, cathodic and anodic reactions are induced. The current produced by RISA can be used to measure radiation intensity. Since RISA occurs with β-, γ-, and X-rays, applications in various fields not only in engineering but also in physics and medicine are possible.

A prototype radiation detector we developed uses a sensor that consists of a rutile TiO_2 film backed by an Al_2O_3 layer (Figure 1). This sensor is very light and small (Fig. 2), enabling a compact design of the overall detector, a feature suitable for marine applications. A series of tests with this detector reveled that it has many advantages over conventional detectors (Table 1). It is stable both chemically and physically, easy to handle, and low in cost. The robustness under strong radiation makes it possible to measure radiation intensity for several months. Furthermore, using several layers of backing plates coated with TiO_2 is found to enhance sensitivity. These advantages suggest the possibility that the RISA radiation detector will have wide applications in radiation measurement.

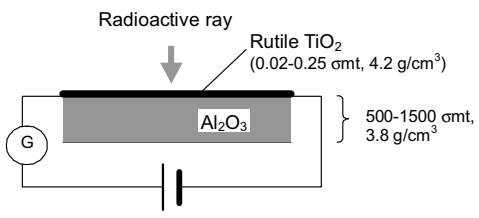

Fig. 1 RISA radiation detector

Fig. 2 Small sensors
(The coin is 2cm in diameter)

Table 1 Advantages of RISA detector

	Convenience	Robustness	Strong radiation measurements	IC	Simplicity	Response	Range	Cost
Ionization	△	×	○	×	○	△	○	○
GM tube	△	×	○	×	△	○	○	△
Scintillation	△	×	○	×	△	○	○	△
Film badge	◎	◎	◎	△	○	×	△	○ Once
Thermal luminescence	◎	△	○	×	○	×	△	○
Semi conductor	○	△	×	△	×	◎	△	△
RISA detector	◎	◎	◎	◎	◎	◎	◎	◎

◎ Excellent ○ Good △ Average × Poor

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