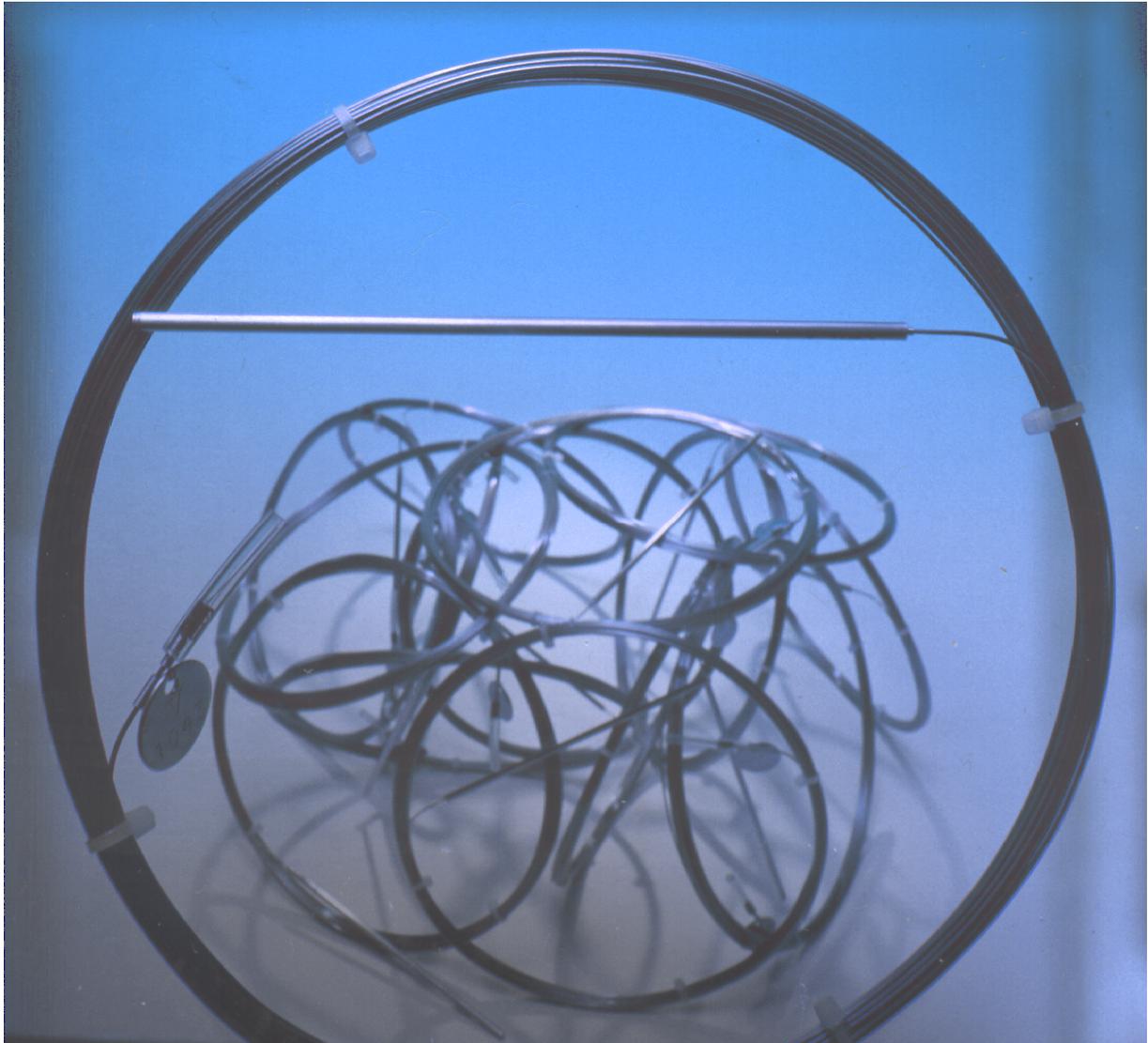


Self-powered Neutron Detector 5503



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KWD

**NUCLEAR
INSTRUMENTS**

The KWD Nuclear Instruments Self Powered Neutron Detector - the SPN detector - for in-core measurement of thermal neutron flux is the successful result of an advanced development project followed by a long in-core reactor testing period lasting over several years.

It can be used in all types of reactors to provide information and signals for safe reactor operation and control. The detector is self-powered, and therefore has no need of a high voltage supply

It has an exceptionally long guaranteed life of more than 8 years. This is a considerable advantage since it reduces the "hot" disposal requirements and the risk for radiation exposure of the maintenance staff.

Function

The detector consists of three main parts: emitter, insulator and collector, arranged in a coaxial geometry.

During operation there is a thermal neutron interaction with the emitter, which results in the emission of the high-energy electrons generating a current directly proportional to the neutron flux.

With an emitter of cobalt, the SPN detector will function as a prompt neutron detector with fast response to changes in the neutron flux.

A twin lead coaxial cable facilitates correction of the current due to the irradiation of the cable. However, it is also possible to use a single lead cable.

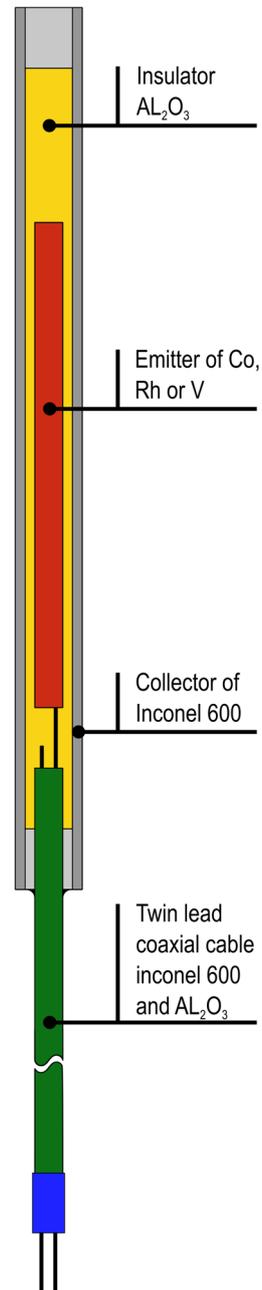
Applications

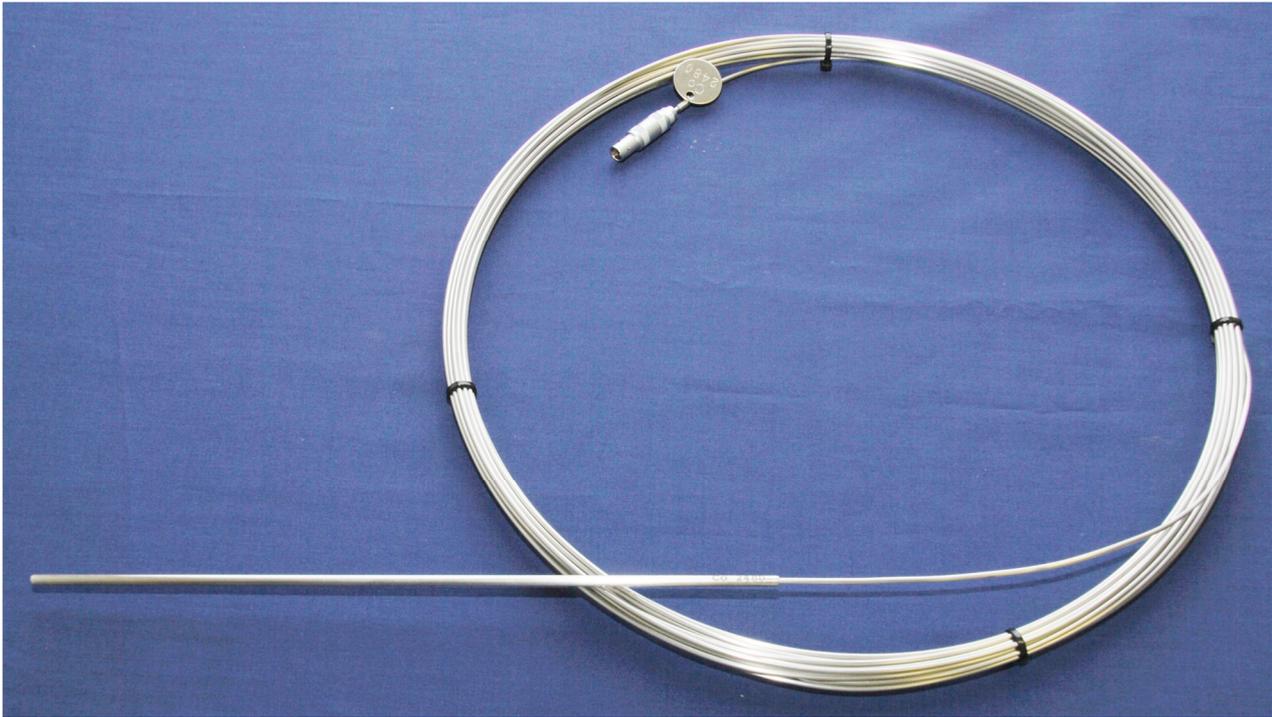
The SPN detector is suitable for different kinds of in-core measurement:

- In the safety system because of the prompt response
- For monitoring and control of local power
- For monitoring of average power
- For flux mapping
- For fuel management

Usually several detectors are mounted together in assemblies. Also other types of in-core detectors, like thermocouples, can be included in the assembly. A typical BWR equipped with SPN detectors has about 30 assemblies with four detectors in each assembly. In some PWRs, up to 300 SPN detectors have been used.

Self-Powered Neutron Detector





Experience

Years of experience and many thousands of detectors installed worldwide have demonstrated the following advantages:

- Since no electrical supply is needed for the SPN detector, it is insensitive to noise and interference from surrounding equipment.
- No significant impairment in operation due to from corrosion in wet reactor environment.
- Sensitivity spread within $\pm 2\%$
- Low gamma sensitivity gives sustained accuracy over its lifetime.
- Linear response verified over the range 5-125% of full power.
- The waste handling problem is minor in comparison to safeguard handling of the fissile material in fission chambers.

Testing

The KWD Nuclear Instruments production process of a SPN detector fulfills the quality assurance requirements:

- KTA 1401 (Nuclear safety Standard Commission) General requirements regarding quality assurance.
- IAEA 50-C-Q Quality Assurance for safety in nuclear power plants and other nuclear installations.

The SPN detectors are seismic qualified according to IEEE 344 and IEC 68-2-6, and LOCA tested according to IEEE 323.

Metallurgic tests of brazing procedure of SPND (SA1985).

The following test can be carried out on the SPN detectors upon request:

- Radiographic inspection
- Resistance measurement
- Helium leak test
- Cold water pressure test