



Contribution ID: 430

Type: Oral

Nuclear-Based Monitoring of Industrial Mass Flow I: The Potential Use of Small Transportable Neutron Generators

Friday, 28 April 2017 09:00 (10 minutes)

Radiotracers for industrial monitoring are produced mainly by two main methods: 1. Activation in research nuclear reactors (RNR) or at charged particle accelerators and 2. by radiotracer generators (RG). Both methods face challenges:

1. The production by activation is often difficult from both administrative and technical reasons. Administrative reasons imply that the production of specific radionuclide has to be known and authorized at the irradiation facilities. Technical reasons imply that irradiation facilities are often non-existing in many countries. Where irradiation facilities do exist, there are limitations due to periodical shut downs. Finally, transportation time between irradiation facilities and industrial site limits again the use of short half-life radiotracers.
2. The number of commercially available radiotracer generators for industrial use is rather limited for the moment. Other options for nuclear-based monitoring of industrial mass flow that appear may therefore be interesting to pursue.

One such option is the application of recently developed small-sized neutron generators. Two types of neutron generators are available using deuterium-deuterium (D-D) reaction (neutrons at 2.45 MeV) and deuterium-tritium (D-T) reaction (neutrons at 14.1 MeV). Commercial D-T generators may produce neutron outputs of $> 10^{11}$ n/s. Unlike isotopic neutron sources, the neutron generators contain no radioactivity (except the inventory of tritium in the D-T neutron generator) making them inherently safe (no external radiation) when turned off.

This presentation will review the current status of such neutron generators and discussed possible applications for use in industrial in-situ or even on-line monitoring processes. The various approaches include on-site production of radiotracer by off-line irradiation of suitable target, on-line and in-situ generation pulses of short-lived radiotracers from macro-elements in the flow, direct continuous activation of matrix elements in the flow, activation of injected pulse of a stable chemical compound, PGNAAs of injected non-radioactive tracer pulse, neutron transmission measurement after pulse injection of a strong neutron absorber and others. The broad industrial use of such techniques is at present in its infancy, and a considerable R&D work remains to be done to ensure the robustness of the different approaches.

Country/Organization invited to participate

Norway

Primary author: Mr BJORNSTAD, Tor (Institute for Energy Technology, Norway)

Presenter: Mr BJORNSTAD, Tor (Institute for Energy Technology, Norway)

Session Classification: B15

Track Classification: RADIATION TECHNOLOGIES FOR MEASUREMENT