



Contribution ID: 150

Type: Poster

## Synthesis Method of Multimodal Radiotracers for Industrial Processes and Environmental Research

*Wednesday, 26 April 2017 14:15 (2 hours)*

### Background

Radiotracer methodology has been described extensively in the literature. Though radioisotopes have been applied to the solution of problems in industry for over 60 years, research and development of the technology continues unabated. Their role in investigating industrial problems has been expanding both in routine testing and process research and development. Extensive experience has been gathered all over the world in application of radiotracers in industry. There are many reasons for the continuing interest. One of the most important is industry driven. Multimodal radiotracers with other specific properties (fluorescent or magnetic properties) are attractive field of investigation. It can be used for mass transport experiments into copper metallurgy industry. Such studies require the development of representative tracers in order to follow raw material particles along their routes of transfer. Second great area of interesting is using radiotracers into environmental research field. Radiotracers are used primarily to reveal the transport processes, dispersion and settling of industrial waste in the natural environment. With their limited environmental impact, radiotracers have the potential to be used in a variety of new applications to create a wider awareness of the environment and the challenges it faces.

### Methodology

The objective of the work is developing of novel multimodal radiotracers with optical and/or magnetic properties. Basing on our experience, silica crystals  $\text{SiO}_2$  have been selected as a matrix for radiotracer. This kind of material is easy to obtain by advanced chemical-ceramic method called sol-gel process. Gels in the forms of powders were prepared by hydrolysis and subsequent polycondensation of tetraethoxide/Me nitrate solutions containing ascorbic acid (ASC) as a catalyst, instead of the  $\text{HCl}$  or  $\text{NH}_4\text{OH}$  that are routinely used for catalysis in this kind synthesis. During the formation of the silica gel various metals can be immobilized into crystal structure of silica particles. The material is sintered and milled. Finally the metal incorporated into the structure is activated into neutron flux and radiotracer is ready to use.

### Results

Following our method we obtained several samples of various radiotracers. As a radiotracer  $^{192}\text{Ir}$  was selected. Iridium is easy to activate into neutron flux and the half-life time of  $^{192}\text{Ir}$  seems to be acceptable. For obtaining fluorescence or magnetic properties we can use a various additives. The properties of the tracer was investigated on fluorimeter, magnetic resonance and gamma spectroscopy.

### Conclusion

The advanced radiotracers with combined properties are very unique and can be used for wide range of applications. Proposed materials can be used for wide range of industrial and environmental applications. Modified sol-gel process is suitable and efficient method for synthesis of this kind of radiotracers.

### Acknowledgments

This work is part of the projects: "Nano-radiotracers with magnetic and fluorescence properties for labeling of micro-particles of sand and clay." co-financed by Polish Ministry of Science and Higher Education and IAEA.

## **Country/Organization invited to participate**

Poland

**Primary author:** Mr SMOLINSKI, Tomasz (Institute of Nuclear Chemistry and Technology, Poland)

**Co-authors:** Mr CHMIELEWSKI, Andrzej (Institute of Nuclear Chemistry and Technology, Poland); Mr WOJ-TOWICZ, Patryk (Institute of Nuclear Chemistry and Technology, Poland)

**Presenter:** Mr SMOLINSKI, Tomasz (Institute of Nuclear Chemistry and Technology, Poland)

**Session Classification:** P-B

**Track Classification:** RADIATION TECHNOLOGIES FOR MEASUREMENT