Plenary and Session Lectures

E1

Actinide-specific Complexing Agents: their Structural and Solution Chemistry

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E2

Plutonium and Americium Processing Chemistry and Technology

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(To be published later as a full paper).

E3

Environmental Actinide Chemistry

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E4

New Industrial Applications of the Lanthanides

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The only deposit in the world mined solely for its lanthanide content is that of Molycorp at Mountain Pass, California, U.S.A. The current processes for producing commercial quantities from this ore will be illustrated and described. The present industrial applications in the areas of metallurgy, glass, ceramics, catalysts, and phosphors will be briefly summarized.

New uses for lanthanides, as metals and as compounds, in various technologies are under development by many companies. The principles underlying the following potential uses, and others, will be considered:

in *Glass* – as a melting aid to reduce the temperature required for melt homogeneity;

in *Metals* – as dispersion strengtheners in high performance alloys;

in *Ceramics* – as sintering aids in the production of new ceramics;

in *Catalysts* – for the control of sulfur dioxide emissions.

E5

Recent Chinese Research on Analytical Chemistry of the Rare Earths

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(To be published later as a full paper)

E6

The N,N′ Di-Alkyl-Amides as Alternative Extractants of some Actinides: a Review of Research Work Carried out at E.N.E.A.

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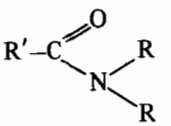
NN′-Di-alkyl-substituted alkyl amides:



$R' = C_4–C_8$

$R = C_3–C_4$

are good extractants of some actinides such as U, Pu and Th. Because of some characteristics these compounds present favourable aspects to the TBP. For example:

i) their radiolitical or chemical degradation products do not effect the extractive process and do not accumulate into the organic phase in a liquid–liquid extractive procedure.

ii) the aliphatic chain structure changes strongly the extractive capacity of some amides especially with regard to the tetravalent ions.

iii) the branching has seen to effect also the trend of the distribution curves in a different way for two ions so that it is possible to foresee a separation in certain experimental conditions of two actinides (U, Pu) at a prefixed ratio.

These advantageous characteristics induced us some years ago to start a systematic research with the aim to investigate better these compounds and to propose some of these compounds as alternative of TBP in some specific applications.

Being those compounds not for the moment commercial products, we have synthetized many of those amides for a systematic study of the effect of the structure on the chemical-physical characteristics and on the extractions behaviour.

The investigation permits us to propose some of these compounds, in original flow-sheet for the separation from the fission products of the couple U–Pu and U–Th and for their final purification.

E7

The Biological Behaviour and Toxicology of Plutonium and Transplutonics

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The biological behaviour of plutonium and transplutonics depends upon the physico-chemical properties of the incorporated radionuclide and upon biological factors. They can enter the body either by inhalation, by ingestion or through wounds. Inhalation is the most likely route of accidental intake in workers, while ingestion can be considered as the pathway to the general population from discharges to the environment due to routine or accidental releases. All the transuranium elements translocated from the site of entry by the circulating blood are deposited in the same tissues and organs; they accumulate in two major organs, bone and liver, both of which represent more than 90% of the activity cleared from the blood.

Acute and medium-term effects are due to very high radiation doses which would only occur in extreme accidental situations. The level of activity deposited in the lung after inhalation of plutonium which will cause death of half of an exposed population within a few months is evaluated around 3.7 MBq (100 μCi). The main delayed effect is the development of cancer, which has been demonstrated in experimental animals, and which occurred mainly in the lung and in the skeleton. Those effects have been observed at levels much greater than those likely to be encountered in man. The frequency of lung cancers following inhalation of actinides increases with the dose up to a maximum and then decreases at higher doses as a result of cell sterilization and death. No evidence of hereditary effects resulting from the incorporation of actinides in the gonads has been demonstrated in any of the animal species studied.

There are no data on the development of cancers in humans as a result of incorporation of plutonium or any transplutonic. Estimates of risk have therefore been based on the results of epidemiological studies on humans exposed to external radiation, and on some available information on the development of bone and liver cancers as a result of intakes of other alpha emitters.

At present the methods for removing accidental intakes of plutonium and transplutonics from the body are moderately successful. For removing the transportable forms, the administration of the chelating agent DTPA is presently the recommended method. If insoluble forms are inhaled, bronchopulmonary lavage is the only effective treatment.