PAPER

Recycling of rare metals from the decommissioning of nuclear facilities

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The lecture „Recycling of rare metals from the decommissioning of nuclear facilities" should introduce the eponymous research project. It is supported by the German Federal ministry of Education and Research and will start on January 1st 2014.

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ABSTRACT

The German Government decided in 2011 to phase out nuclear power. Thus, 17 power reactors will be shut down within the next 11 years and to be decommissioned. An interesting question is, in which extent rare metals of strategic economic importance can be recycled within the scope of decommissioning. To be named are valuable bulk metals like copper, aluminium and lead, but also rare metals like indium, niobium, vanadium, cobalt, or tin and rare earth metals.

Due to high requirements in terms of material technology, materials found in nuclear reactor components are of particular importance when it comes to recycling. These include components of the primary cooling system (RPV-internals, control rods and grid-structures) components for process control systems and components from the non-nuclear part of reactors (pumps, valves, heat-exchangers or boilers).

Especially the radiologically controlled melt-down of metals is used as an alternative to free release or disposal. This process has some serious disadvantages, thus it seems to be appropriate optimizing the decommissioning process regarding recycling of valuable metals.

The work schedule for pre-investigation is outlined for 18 months and can be summarized as follows:

- Requesting design, operational and material data
- Data from a sample facility: detailed specification of used components, substances contained and data from related activation calculations, fluence-values and contamination
- Setting up a database to assign non-ferrous metals and components with additional data like activation and decay time possibly needed, concentration, distribution, total mass, aggregate state, state of chemical bonding and recyclability
- Determining the activation distribution to evaluate if a components is recyclable at all, thus: preparation of an MCNP-model, simulation of n-fluence and application of variance-reduction-methods to optimize activation calculations
- Classification of recyclability considering the following criteria: total mass, concentration and distribution in structural material, state of chemical bonding, texture of the material and extent of impurities
- Selecting und combining the process chains necessary to treat the respective materials
- Assessment of cost effectiveness of the overall process

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