ALES

Actinide- lanthanide separation

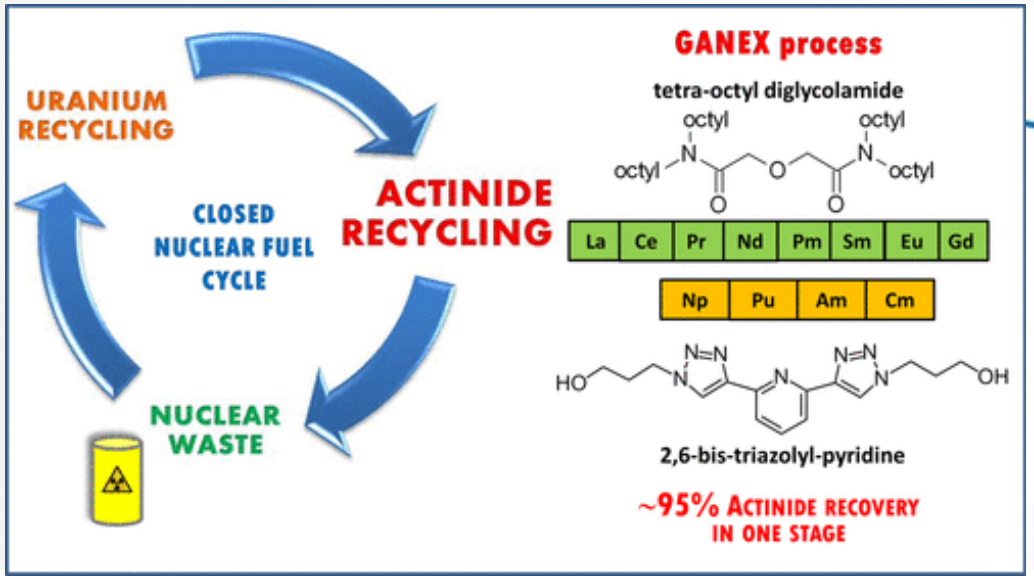
Otto-Matti Hiltunen & Risto Koivula
Ion Exchange for Nuclear Waste Treatment and Recycling
University of Helsinki, Department of chemistry

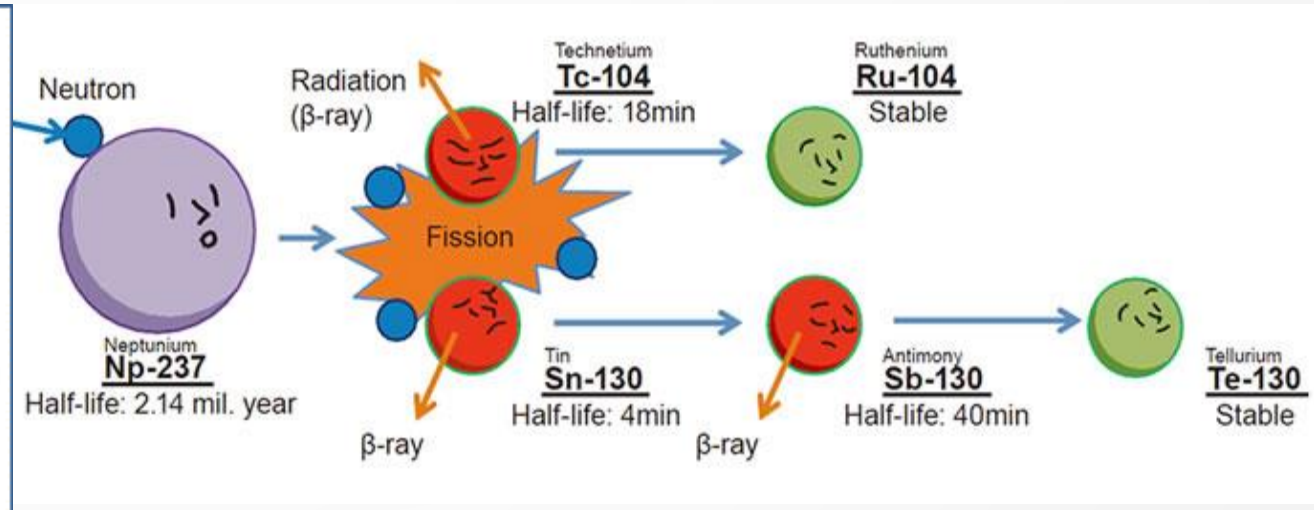
Ales

Actinide **l**anthanid**e** **s**eparation

Nuclear Waste Management Technologies (3.2.1 Framework Programme)

- How the world is developing with alternative nuclear waste management technologies
- Train experts available for authorities for rational decision making
  - Ph.D. for Advanced Fuel Cycle / Partitioning and Transmutation (P&T) area





SOLID PHASE EXTRATION (SPE) MATERIALS FOR PARTITIONING PROCESS

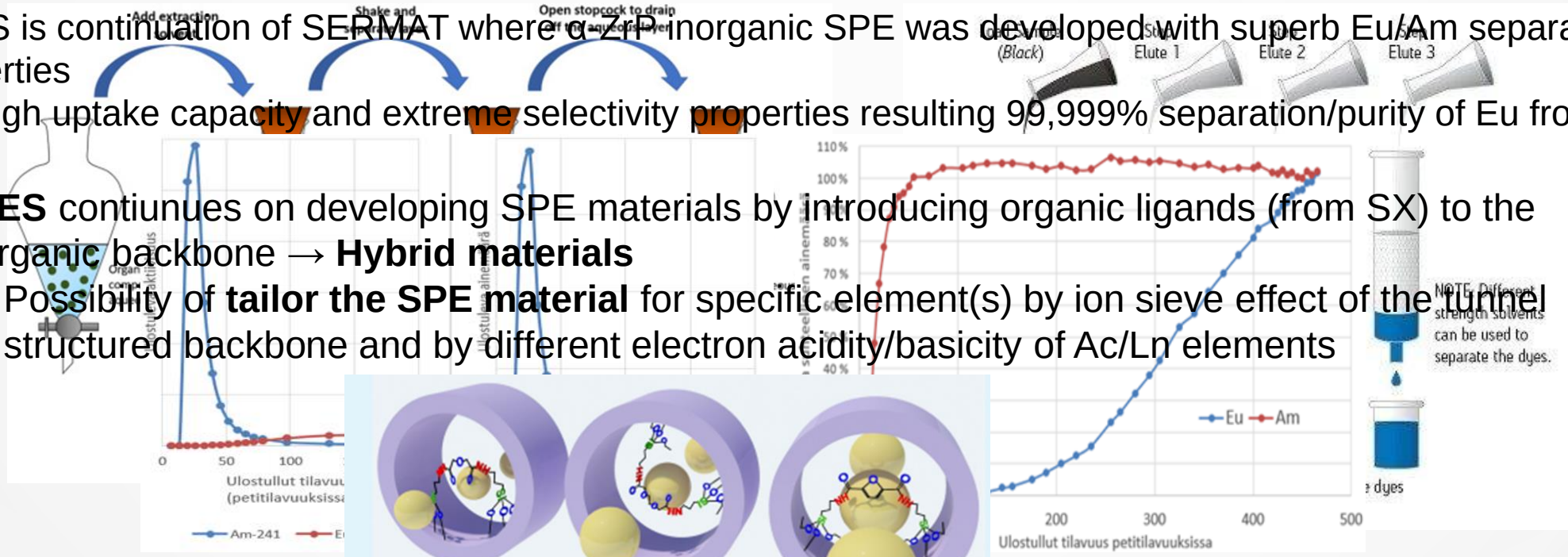
- Solid phase extraction materials have potential to outperform existing technology (SX)
  - •Robust, simple, cost efficient, less hazardous

ALES is continuation of SERMAT where α-ZrP inorganic SPE was developed with superb Eu/Am separation properties

- High uptake capacity and extreme selectivity properties resulting 99,999% separation/purity of Eu from Am

ALES contiunues on developing SPE materials by introducing organic ligands (from SX) to the inorganic backbone → **Hybrid materials**

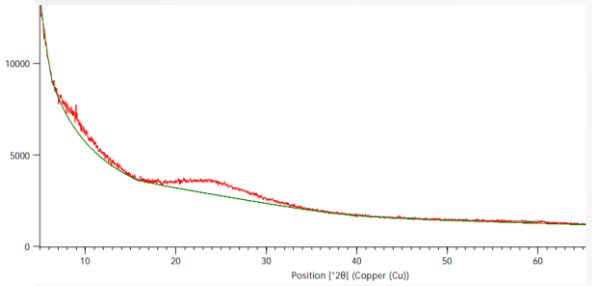
- Possibility of **tailor the SPE material** for specific element(s) by ion sieve effect of the tunnel structured backbone and by different electron acidity/basicity of Ac/Ln elements

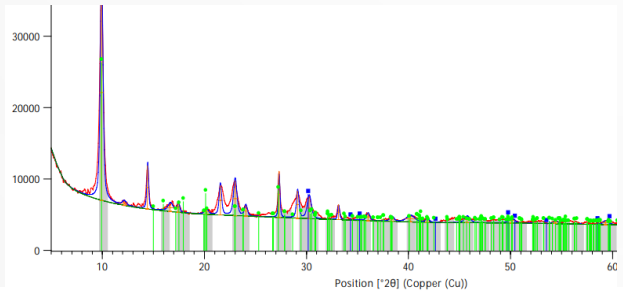


TAILORED HYBRIDS

Metal oxides as backbone

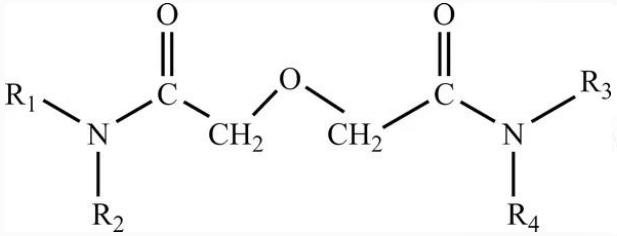
- High chemical, mechanical, thermal and radiolytic tolerance
  - TiO2, SnO2, ZrO2
  - Variation of tunnel size
    - 5 to 20 nm → sieve effect
  - Crystallinity
    - Via chemical and physcial means
      - Intensifies sieve effect

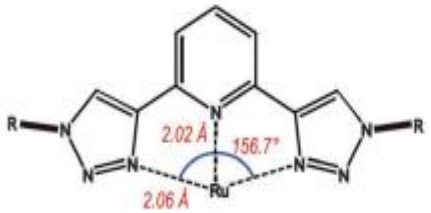


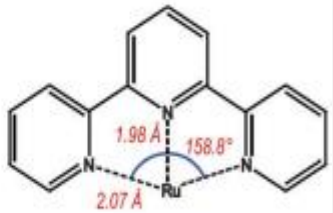


Organic ligands similar to SX method

- Variation on electron acidity/basicity
  - Oxygen (Ln) of nitrogen (Ac) rich ligands

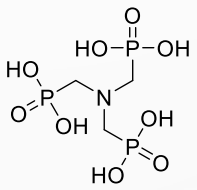






- Variation on ligand length/conformation

ATMP



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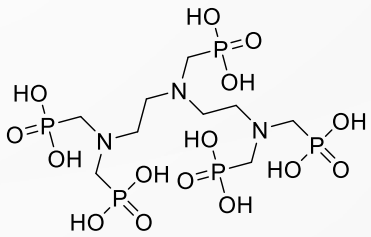

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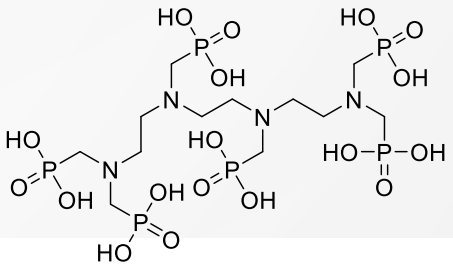
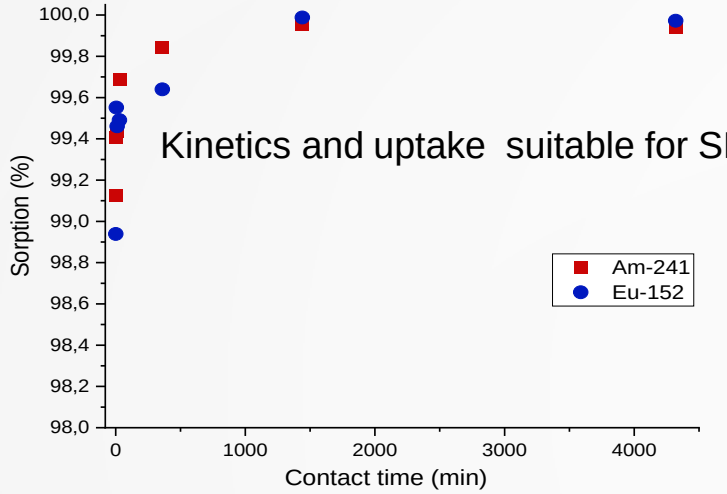
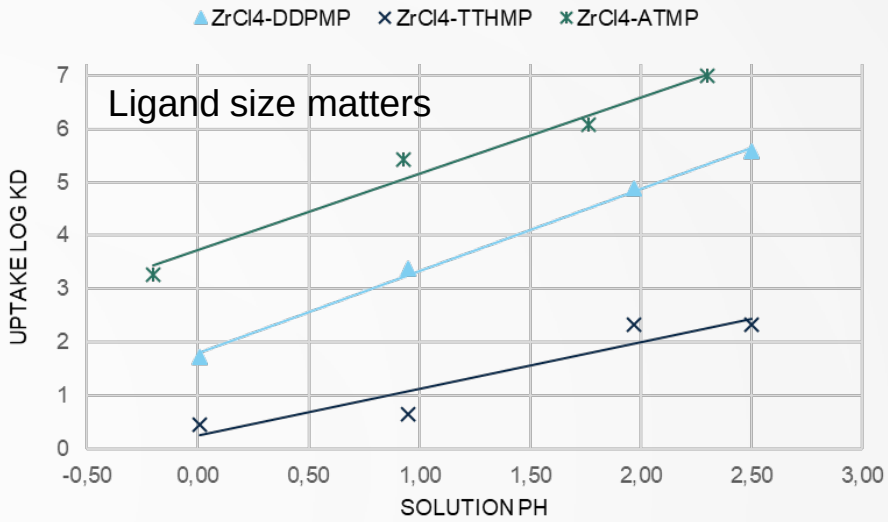
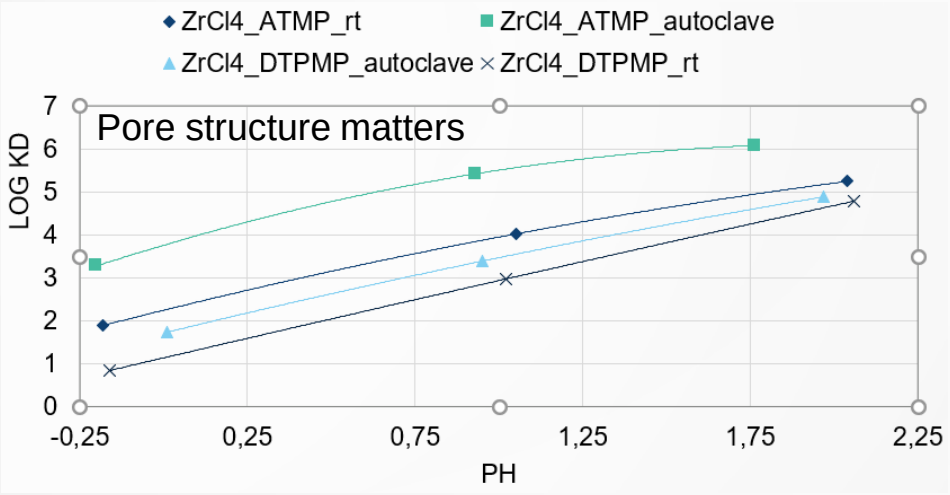
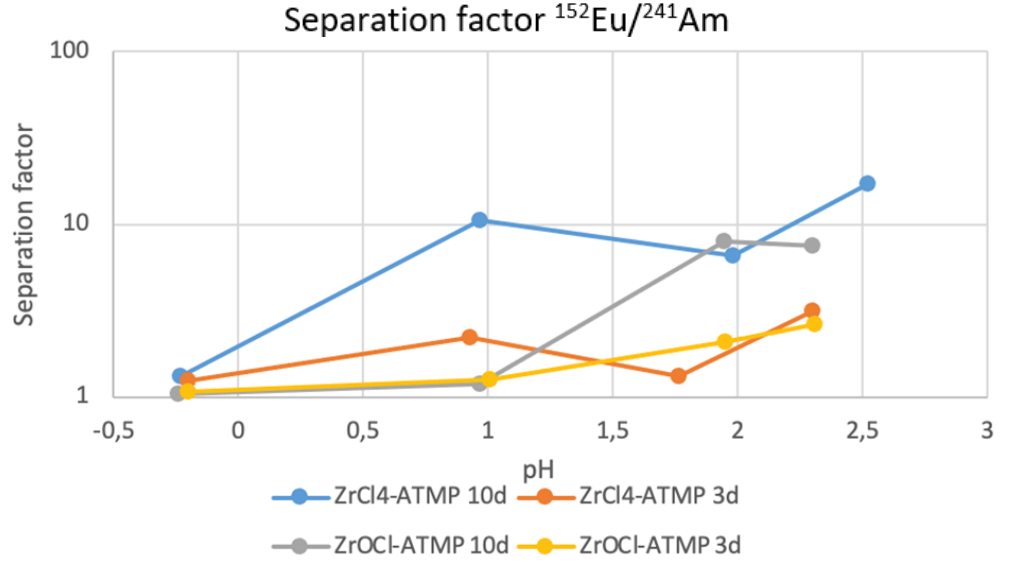


TAILORED HYBRIDS



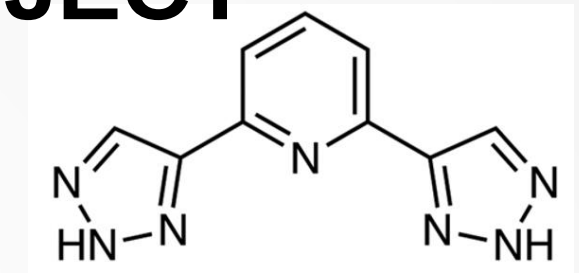


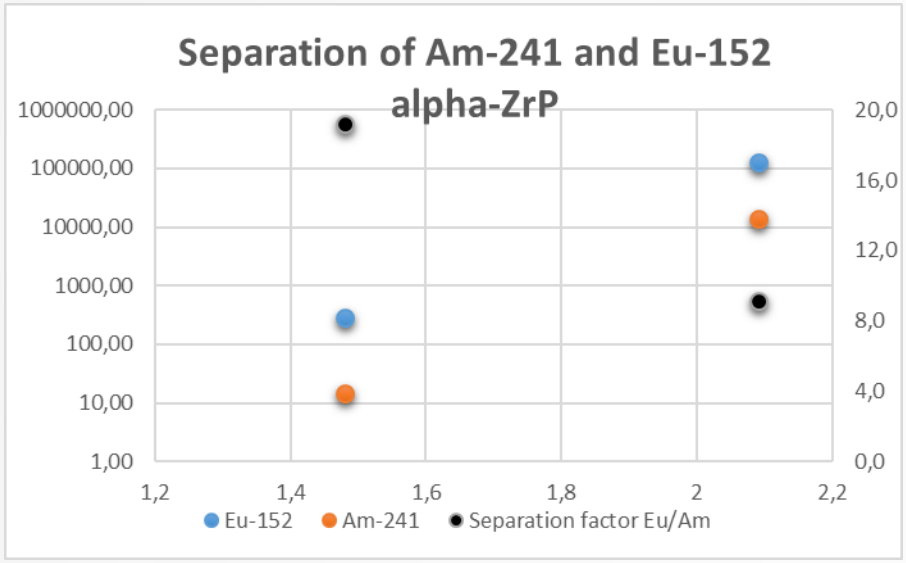


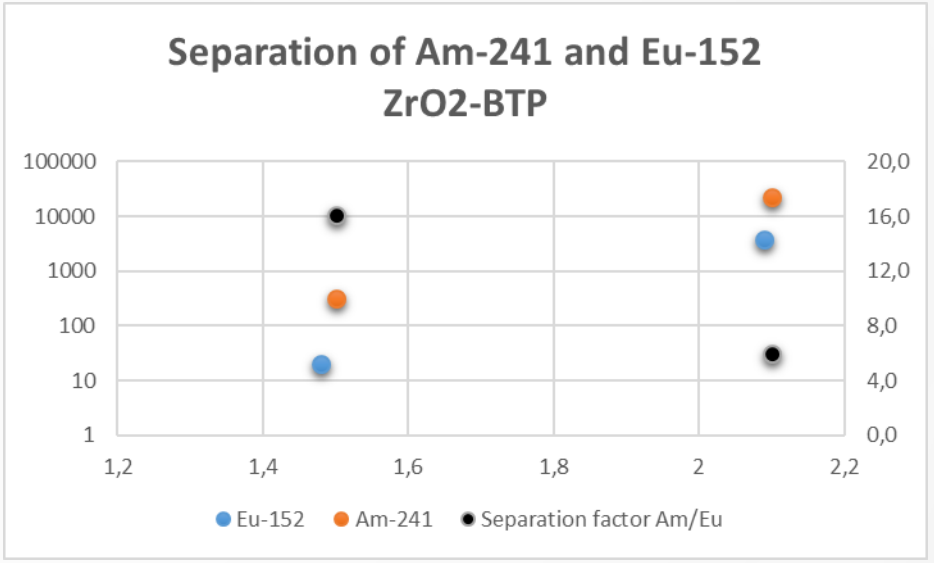


MAIN RESULTS OF ALES PROJECT

- The hypothesis of the project application were proved to be right **Tailoring** was **successful** and hybrid favoring Am was synthesized – first time reported for SPE-material

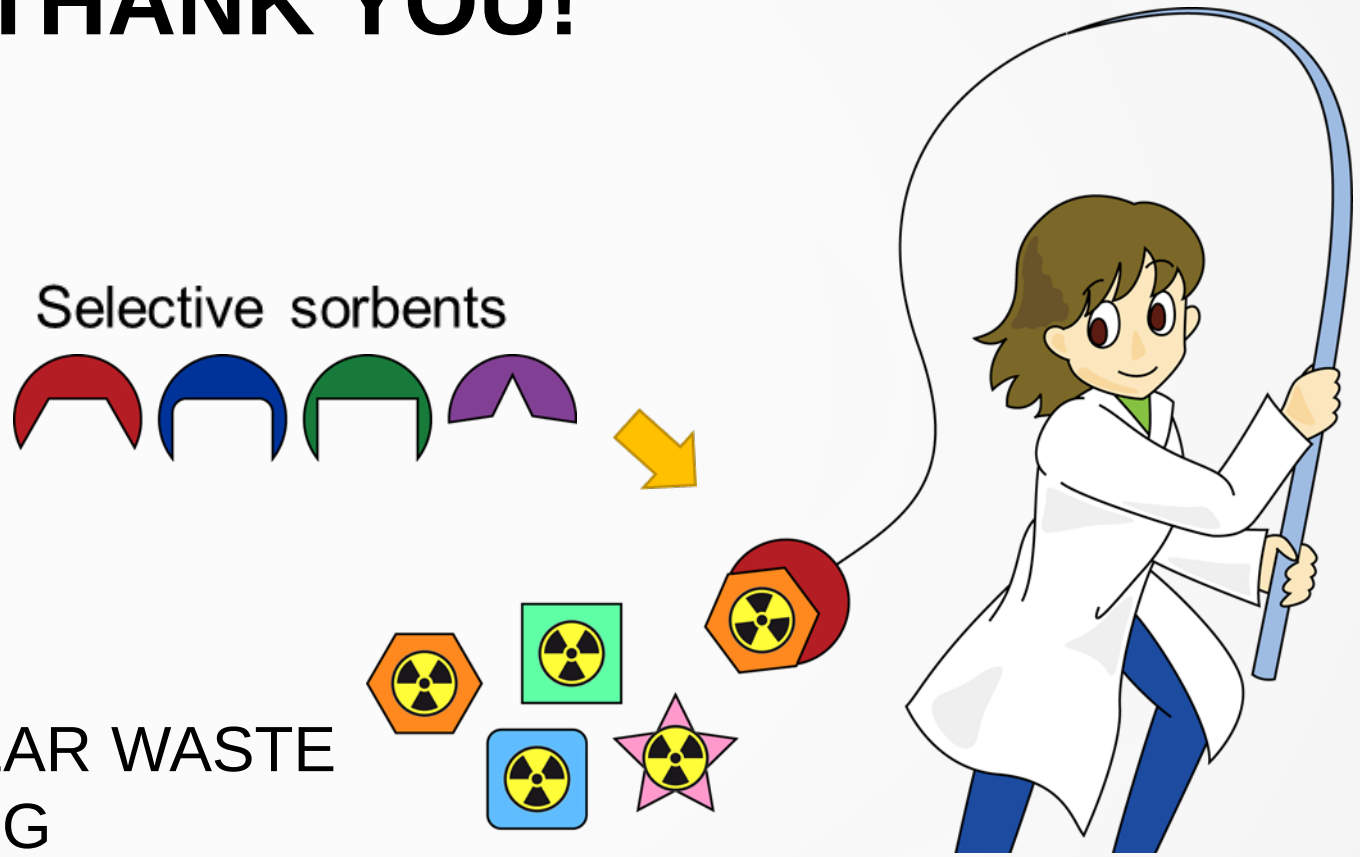






- Doctoral education (PhD) in the field of P&T (partitioning and transmutation) - separation techniques → **Expert** in the field of Advanced nuclear fuel cycle

THANK YOU!



RESEARCH GROUP

ION EXCHANGE FOR NUCLEAR WASTE TREATMENT AND RECYCLING

https://www.helsinki.fi/en/researchgroups/ion-exchange-for-nuclear-waste-treatment-and-recycling