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16127

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# Dissolution of Spent Nuclear Fuel in Carbonate-Peroxide Solution

## SUMMARY

Researchers at PNNL have developed new methods for treating irradiated nuclear fuel that represent improvements over the conventional PUREX process. It has been demonstrated that irradiated nuclear fuel can be dissolved readily at room temperature in a non-corrosive and low-hazard solution of ammonium carbonate and hydrogen peroxide. The uranium dissolves completely with most of the plutonium and fission products remaining behind as an insoluble heel; this separates the uranium from plutonium and the majority of the radioactivity at the initial dissolution step. Uranium can be easily recovered from solution by any of several means, such as ion exchange, solvent extraction, or direct precipitation. Other useful elements may be extracted from the mixture as well. The ammonium carbonate can be evaporated out of solution and recovered for re-use, leaving an extremely compact volume of fission products mixed with transuranic elements. Stack emissions using the technology are less toxic, less radioactive, chemically simpler, and simpler to treat than those from the PUREX process.

## ADVANTAGES

- \* More efficient method for treating spent fuel from a reactor. In fact, using this method, spent fuel is separated into lower toxicity groups more easily than the current PUREX method.
- \* Less expensive and less toxic reagents are used in the process: ammonium carbonate and hydrogen peroxide.
- \* Lower stack emissions reduce the opportunity for fission products and toxic chemicals to be released into the environment.

## RELATED LINKS

### » Dissolution of spent nuclear fuel in carbonate-peroxide solution

Published by Journal of Nuclear Materials. Issue 396 (2010) 159-162.

[http://www.sciencedirect.com/science?\\_ob=MIimg&\\_imagekey=B6TXN-4XMD5SP-1-5&\\_cdi=5595&\\_user=2741876&\\_pii=S0022311509008848&\\_origin=search&\\_coverDate=01%2F31%2F2010&\\_sk=996039997&view=c&wchp=dGLbVtz-zSkzV&md5=ebb96a439e42cd156d425447aca9d795&ie=/sdarticle.pdf](http://www.sciencedirect.com/science?_ob=MIimg&_imagekey=B6TXN-4XMD5SP-1-5&_cdi=5595&_user=2741876&_pii=S0022311509008848&_origin=search&_coverDate=01%2F31%2F2010&_sk=996039997&view=c&wchp=dGLbVtz-zSkzV&md5=ebb96a439e42cd156d425447aca9d795&ie=/sdarticle.pdf)

### » Dissolution of uranium metal without hydride formation or hydrogen gas generation

Published by Journal of Nuclear Materials. Issue 378 (2008) 299-304.

[http://www.sciencedirect.com/science?\\_ob=MIimg&\\_imagekey=B6TXN-4STYV5C-1-9&\\_](http://www.sciencedirect.com/science?_ob=MIimg&_imagekey=B6TXN-4STYV5C-1-9&_)

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list\_item&\_coverDate=09%2F01%2F2008&\_sk=996219996&wchp=dGLzVzb-zSkzS&  
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### Technology Portfolio(s)

- » Radiochemical Processing

### Potential Industry Applications

- » Energy & Utilities
- » Public Administration & Government
- » Recycling & Waste Management

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