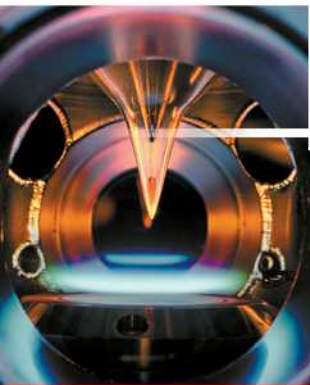


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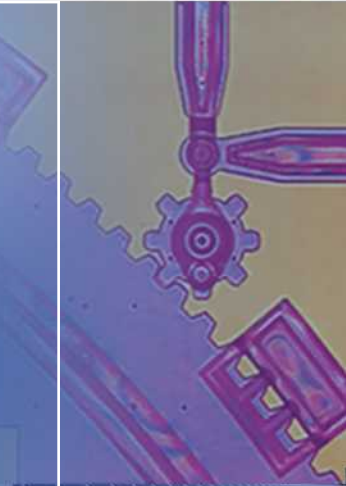
SANDIA NATIONAL LABORATORIES

Nitrated Bitumen Waste

Ideas for Determining the Reactivity of the Waste



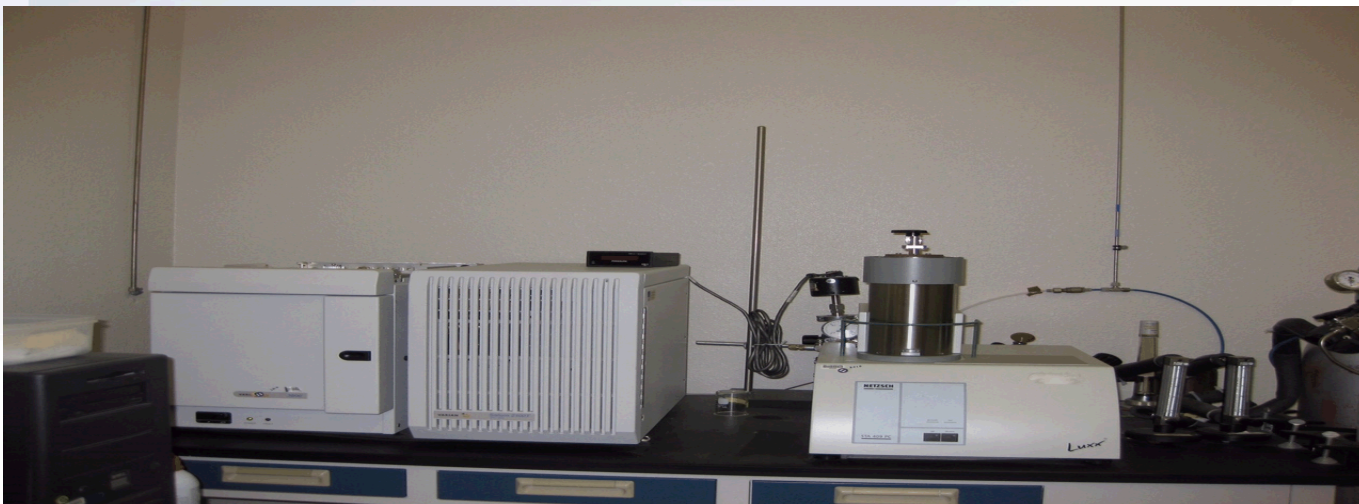
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TGA/DSC-GC-MS

- Thermogravimetric Analysis (TGA) can provide information on reactions such as combustion by detecting rapid increases in temperature and weight loss from the sample.
- TGA coupled with Gas Chromatography Mass Spectrometry (GC-MS) will enable quantitative analysis of the evolving gases and bi-products as a result of heating of the nitrated bitumen.
- Destructive analysis technique.



^{13}C - ^{14}N MAS (SPIDER)

- Coupled ^{13}C - ^{14}N Nuclear Magnetic Resonance with Magic Angle Spinning (MAS) can provide information on nitrogen connectivity to carbon in organic solids.
- Saturation Pulse Induced Dipolar Exchange with Recoupling (SPIDER) is a technique that enables the detection of nitrogen connectivity with aromatic carbon.
- Non-destructive Analysis.



Thoughts/Questions to Consider

- **Could slow reactions (nitration) over time result in the build up of gases such as hydrogen over time?**
- **Is there a stabilizer added to the waste that prevents nitration?**
- **What are the net effects of thermal, radiolysis and nitration on the bitumen?**
- **How well characterized is the bitumen?**
 - **Aliphatic vs aromatic content**
 - **Synthetic vs natural pitch**
 - **Are there possible catalysts present that would facilitate nitration?**



A Possible Research Path Forward

- **Use a combination of destructive and non-destructive techniques to determine if nitrate is combining with bitumen and determine if the nitrated bitumen is reactive or combustable.**
- **Examine nitrate bearing bitumen as well as nitrate free bitumen.**
- **Analyzing samples of actual bituminized waste would be optimal.**
- **Analyzing the reactivity of model compounds such bitumen monomers or similar compounds may also be instructive.**
- **A literature search on nitration of aromatic compounds and their reactivity/stability would be a good place to start.**