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Preliminary Research on Monitoring Uranium Fluoride Volatility Process by Fourier Transform Infrared Spectroscopy

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Fluoride volatility method is regarded as a promising pyrochemical reprocessing technology, which might be used to reprocess spent fuels. How to monitor fluorination process on time and precisely is very important. Currently, the methods of monitoring fluorination in industry are mostly the weighting the product and sampling then off-line analysis. The former is poor in the precision, and the latter cannot reflect the current situation. In this research, the Fourier transform infrared spectroscopy (FTIR) was used to detect components and concentration of the outlet gas from UF4 and F2 gas-solid reaction reactor on-line at different time points. From the spectrums, the starting point, end point and reaction rate could be determined. The results showed that UF6 was detected 3min after the beginning of reaction; during the fluorination, the concentration of UF6 in outlet gas increased with time, then maintained at a certain concentration, finally decreased; and the rate constant of fluorination was 0.0027min-1 at 300oC and 0.2L/min 5%F2. In summary, FTIR might be used to monitor the uranium fluorination process with high precision and fast response. However the actual spent fuel is much more complicated compared to this experiment system. There are varied fission products, so that the products of fluorination might become more complex. More research will be carried out to determine whether FTIR can detect the process or not.

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