



Contribution ID: 965

Type: Verbal

The products of radiolysis and hydrolysis of polyacrylonitrile

Tuesday, 17 May 2022 16:08 (18 minutes)

The products of radiolysis and hydrolysis of polyacrylonitrile (PAN) in strongly alkaline conditions were studied using several methods —HRMS, FT-IR and LCMS analysis, combinable HPLC with UV / VIS and refractometry. The studied conditions correspond to the environment formed by cementitious materials utilized as the engineering barrier in the disposals of radioactive waste. Degradation products from materials such as PAN, which are part of the waste, can significantly affect the migration of radionuclides present.

The data obtained from infrared spectroscopy show the common trends: in the region of 3400-3200 cm^{-1} bands are visible, which correspond to the valence N-H vibrations of the amine or amide functional group. Furthermore, bands of valence symmetric and antisymmetric CH_2 and CH_3 groups are visible in the region 2950-2850 cm^{-1} . The band around 2240 cm^{-1} corresponds to the valence vibration of the nitrile group ν ($\text{C}\equiv\text{N}$). The degradation proceeds via intermediates ($-\text{C}=\text{N}$) and amide ($-\text{CONH}_2$) and leads to the formation of a carboxyl functional group ($-\text{COOH}$). The presence of intermediates in the reaction mixture is manifested by characteristic bands of vibrations in the infrared spectrum of the samples. The presence of PAN fragments after hydrolysis was also confirmed by MS spectra.

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Session Classification: Nuclear Fuel Cycle

Track Classification: Chemistry of Nuclear Fuel Cycle, Radiochemical Problems in Nuclear Waste Management