

International Conference on

Nuclear Chemistry

December 08-09, 2016 San Antonio, USA



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Direct mass spectrometry analysis for the understanding of polymers degradation mechanisms

Because of the wide range of formulations, one class of polymer can have different composition (nature of the monomer, quantity and concentration of monomers for copolymers, average molar mass and so on). Their additives can also be adjusted. In the area of polymers analysis, one of the most important interests is to develop analytical methods allowing a fast and complete characterization of its chemical structure. In the very special context of the nuclear industry, and more specially in the nuclear waste safety domain, degradation mechanisms of polymers have to be understood up to doses as high as dozen of MGy. At these doses, materials are highly modified, depending on the polymer kind and on the additives. The first in the understanding of the mechanisms is to characterize materials at different doses. Mass spectrometry allows today to analyze molecules directly from sample for rapid analysis, without any sample preparation. In this study, two ionization sources have been used, Atmospheric Solid Probe Analysis (ASAP) and Direct Analysis in Real Time (DART), for characterization of two industrial polymers, polyurethanes and polyethylene. DART technique allows detection of additives with good intensity, whereas ASAP technique allows a better desorption of high molar mass polymers in function of their volatilization and/or degradation temperature. Thus, these results compare and contrast these two complementary thermal-based ionization techniques for the direct study of crude polymer. In the nuclear context, these two sources allow to help to follow and understand chemical modification of the polymer with dose.

Biography

Diane Lebeau has completed her PhD from UPMC University (Paris, France) and Post-doctoral studies from Roche Diagnostic's laboratories in Germany. She is Research Engineer in the Laboratory of Radiolysis and Organic Matter (LRMO) at the French Alternative Energies and Atomic Energy Commission (CEA, France) since 2009. As a specialist in Analytical Chemistry, she contributes to the research program conducted by the CEA and devoted to small organic molecules and polymer degradation in the nuclear context. She has published 10 papers.

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