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Thermal decomposition of nano-enabled products at their end of life and EHS implications

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Proliferation of Nano-enabled-Products (NEPs) has inevitably raised the urgent question of nano-release during their synthesis, integration, processing, assembly, usage and eventually recycling or disposal at the end of their life cycle (LC). Apparently, there is a need to study and understand in a systematic manner the release mechanisms and possible exposure routes across the LC of NEPs in particular during the thermal decomposition of nanowaste. Here, we focus on the development of a novel Integrated Exposure Generation System which enables the assessment of possible environmental health and safety implications during the thermal decomposition scenario of nanocomposite materials. A specific target is the employment of the developed exposure platform for a variety of polymer nanocomposites that are currently in use in many industries and products such as automotive (engineering plastics for multiple components), electrical (plastics for switches, plugs), construction (insulation foams), packaging (extruded polymers, polystyrene), textile (polyamides, monofilaments). Finally, a detailed physicochemical, morphological, and toxicological characterization of by-products from the thermal decomposition of nanowaste will be performed utilizing the developed exposure system. The target is to link biological responses and properties of released aerosol and residual ash to specific NEP properties and thermal decomposition parameters. Through such an understanding, safer-by-design polymer NEPs can be manufactured that retain the superior properties without exhibiting adverse effects to the environment and human health.

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