Characterization of aerosols emitted during the incineration of nanocomposites

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End-of-life nanocomposites are likely to undergo disposal through thermal treatment like incineration. Data from literature indicate that nanocomposites present specific behaviours according to the conditions of thermal treatment [1]. It is thus relevant to understand the mechanisms of emission and thermal degradation of nanocomposites under incineration conditions. Thence, the characterization of the effluents during the incineration of nanocomposites, collected downstream the incinerator furnace (or even upstream the flue-gas cleaning systems), provides an insight in the "nanosafety" of this technology [2], useful to cope with nanowastes (wastes containing nanomaterials).

At a lab-scale, the emission mechanisms and the thermal degradation mechanisms were determined using various devices: a microcalorimeter PCFC and a fire propagation apparatus (FPA Tewarson) coupled with a Fourier Transformed InfraRed (FTIR); as well as a modified tubular furnace (Fig. 1) coupled with a gas analyser. Conditions of thermal degradation implemented in those laboratory devices were accurately characterized by evaluating and controlling (whenever possible) the key operational parameters that govern an incineration process, *i.e.* chiefly: temperature, residence time, air-excess and turbulence.

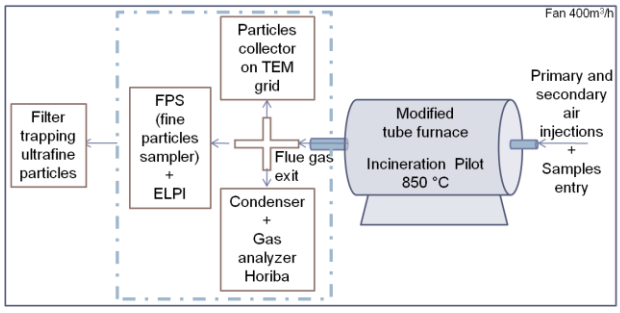

Figure 1. Incineration Pilot - Schematic diagram of the experimental device.

This study reports particularly on the composition and microstructure of the aerosols produced during combustion tests. The size distribution of particles contained in the flue-gas was determined using an Electrical Low Pressure Impactor (ELPI) coupled with combustion devices and the morphology was determined using TEM observation (transmission electronic microscopy) via a MPS (mini-particle-sampler) [3]. Our tests were performed on specimens of nanocomposites incorporating different mineral fillers (like sepiolite and halloysite nanoclays) and neat polymer matrices.

The characterization of the combustion aerosols from the small-scale thermal degradation of nanocomposites is a first step for determining nano-objects potentially released during incineration process.

References

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