THERMOGRAVIMETRIC STUDY OF THE DECOMPOSITION OF PRINTED CIRCUIT BOARDS FROM MOBILE PHONES

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Printed circuit boards (PCB) are particularly problematic to recycle because of the heterogeneous mix of organic material, metals, and glass fibre[1]. More specifically, the presence of Fe and Cu can catalyze the debromination/hydrogenation reaction, accelerating the formation of chlorinated and brominated dioxins and furans[2].

In a previous study[3], the thermal decomposition of used PCB was analyzed. The present work uses TG analysis to compare the thermal behavior of PCB from mobile phones before and after the removal of the metallic fraction. PCB of different mobile phones were separated and crushed to fine dust (sample named "PCB"). To remove the metallic fraction, part of the sample was treated with a dilute aqueous solution of HCl and H_2O_2, followed by washing with deionized water and drying at 110 ºC (sample named "non metallic-PCB"). Elemental and metal analyses were performed to check the process.

Dynamic experiments have been carried out at different heating rates (5, 10 and 20 K/min), from room temperature to 900 K, covering in this way an extensive range of decomposition. Pyrolysis runs were performed in N_2, whereas two atmospheres were used for the combustion runs: N_2:O_2 4:1 (air) and N_2:O_2 9:1 (poor oxygen conditions).

In pyrolysis runs, where only the organic polymer decomposes, the final residue is approximately the same for all the runs, although the residue from the non metallic sample is much lower.

In oxygen presence, the "PCB" sample presents an oxidation of the metallic compounds and this probably generates a different residue at infinite time. The presence of metals and other compounds catalyzes the decomposition of the organic matter. Also, an increase of the weight is observed due to the formation of metallic oxides that lately decompose. This seems to be confirmed by the behavior of the "non metallic-PCB" sample, where no weight gain is observed.

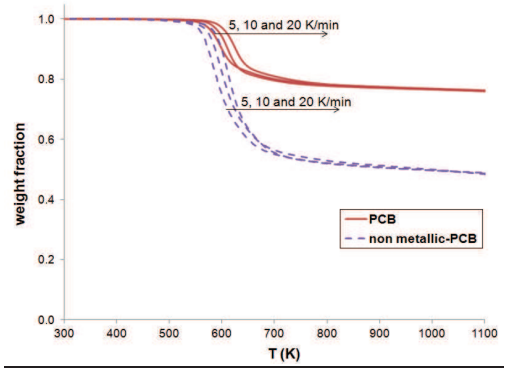

Figure 1. Dynamic runs for pyrolysis.

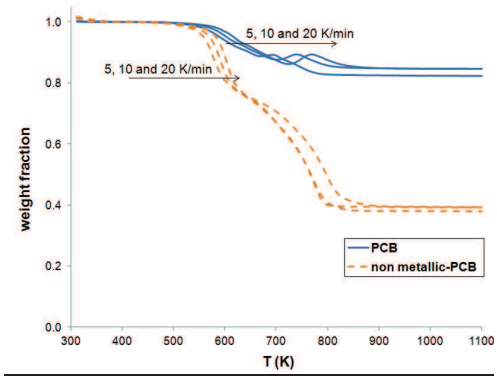

Figure 2. Dynamic runs for combustion in air.

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2. H. Duan, J. Li, Y. Liu, N. Yamazaki, W. Jiang. Characterization and Inventory of PCDD/Fs and PBDD/Fs Emissions from the Incineration of Waste Printed Circuit Board. Environ. Sci. Technol. 2011, 45, 6322-6328
3. J. Moltó, R. Font, A. Gálvez, J.A. Conesa. Pyrolysis and combustion of electronic wastes. J. Anal. Appl. Pyrolysis. 2009, 84, 68-78

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