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Synthesis of carbon nanostructures by chemical vapour deposition over Ni-Al co-oxides using plastic solid waste as precursor

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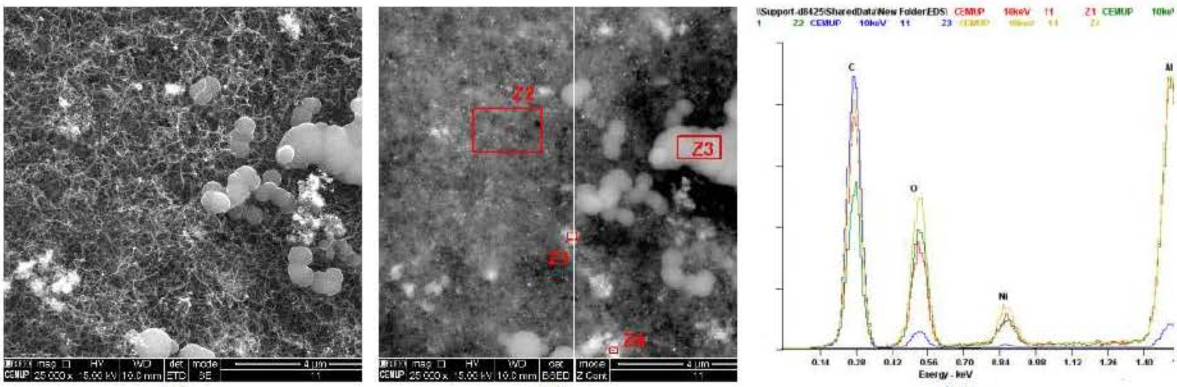
Europe contributed with 18.5% of the almost 350 Mton of plastics produced worldwide in 2017. Polypropylene (PP) and light and heavy density polyethylene (LDPE and HDPE, respectively) represents near 49.1% of the plastics produced in Europe. Packaging is the main application of these plastics, so typically they have one-single use. In 2014, 25.8 Mton of post-consumer plastic solid wastes (PSWs) ended up in the official waste streams (54.0% of the demanded quantity), 69.2% being recovered through recycling (7.7 Mton) and energy recovery processes (10.2 Mton), the remaining 30.8% sent to landfill [1]. Concerns about usage and disposal are diverse and include accumulation of PSWs in landfills and in natural habitats, physical problems for wildlife resulting from ingestion or entanglement in plastic and the leaching of chemicals from plastic products [2]. The incineration of PSWs contributes to pollution due to harmful and toxic emissions and both incineration and mechanical recycling are costly and may or may not be economically viable in different situations [3]. More attractive strategies are the production of carbon nanomaterials using PSWs as carbon precursors [4]. In this work, Ni-Al co-oxide nanoparticles were synthesized by co-precipitation and employed as catalysts in the chemical vapour deposition of CNTs when using LDPE as carbon precursor and as model compound of plastic solid waste. Fig. 1 shows the scanning electron micrographs of the carbon nanostructures prepared at 1000 °C during 1 h in a tubular furnace under 10 NmL·min^{-1} nitrogen flow. As can be observed, CNTs and carbon nanospheres were produced.



(a) (b) (c)

Fig.1. Scanning electron micrographs obtained in (a) secondary electron mode and (b) electron backscattered diffraction, and (c) local elemental analysis.

Acknowledgements

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