Utilization of plastic wastes from electrical and electronic equipment (e-waste)

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Abstract

Growing number of new applications of plastics correspondingly increases the amount of plastic wastes. The plastic wastes, particularly from electrical and electronic equipment (e-waste or WEEE) are highly heterogenous in term of polymers and various additives (e.g. stabilizers, antioxidants, flame retardants). Due to rigorous environmental regulations, the development of practical recycling technologies for these waste plastics becomes increasingly important. In the last decade, research interest in use of plastic wastes for synthesis of the carbon nanomaterials (e.g. particularly carbon nanotubes, carbon fibres, carbon membranes) increased considerably. The advanced carbonic materials have drawn great worldwide attention due to their peculiar microstructures, unique physical-chemical properties, and great potential applications in many fields (e.g. wastewater treatment, air pollution monitoring, biotechnology, renewable energy, etc.). However, generation of the carbon nanomaterials is high energy and resources intensive as demand carbon sources of high purity (e.g. CO, CO_2, alcohols, methane, ethylene, acetylene, n-butene, benzene, toluene or xylene). Exploitation of the plastic wastes as a low-cost carbonaceous feed could provide an economic and environment-friendly approach for carbon nanomaterials generation. Among various methods used for synthesis of these nanomaterials from plastic wastes, the catalytic chemical vapor deposition (CVD) is preferred. Type and quality of the obtained carbon nanomaterials depends on type of (a) plastic wastes (PE, PP, HDPE, PVA, PET), (b) catalysts (Ni and its compounds (e.g. ACs+Ni_2O_3; CuBr+NiO; MAPP+Ni; Ni/Mo/MgO; OMC+Ni), FA stainless steel mesh, and ferrocene), (c) reactors construction and operational parameters. Aim of this study is to demonstrate: (1) generation of various advanced carbonaceous materials from different plastic wastes present in e-waste; (2) challenges associated with quality of used feedstock in terms of composition and contaminations content.

Keywords—*catalytic chemical deposition, carbon nanomaterials, e-waste, pyrolysis*

Professional Biography (100-150 words)

Dr. Sylwia Oleszek has graduated from Wroclaw University of Science and Technology in Poland, followed by Ph.D. course completed from Tohoku University in Sendai (Japan). Currently she holds researcher position at Department of Environmental Engineering of Kyoto University in Japan. Her principal research interests concern technological and environmental aspects of waste management and recycling, valorisation of waste materials, recovery of value-added compounds from wastes, and green technologies for clean environment. She is a member of prominent academic recycling associations in Japan. She serves as an editor-in-chief for Journal of Waste Recycling and as an invited reviewer for number of reputed scientific journals. She published over 100 publications, including original papers, conference proceedings, and book chapters.