WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT – PROCESSING AS THERMOPLASTIC COMPOSITES

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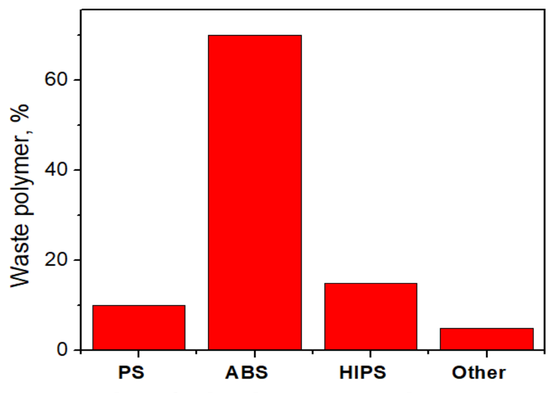
Introduction

In the last decades, waste electric and electronic equipment (WEEE) has increased substantially due to an accelerated development of the economy, the life time of the electronics, or the diversified supply of these products. Proper initiatives regarding the energy consumption, the reduction of disposed solid and wastewater by e-waste recycling, etc. can reduce the environmental impact.

The research was focused on processing some compositions containing WEEE, by extrusion and injection molding. The amount of waste was selected based on the processability and mechanical properties of the compounds containing different percent of WEEE polystyrene fraction and waste printed circuit boards (WPCB), respectively, obtained by melt compounding. The characteristics were tested after modifying the polystyrene fraction of WEEE with styrene-butadiene block-copolymer. For waste printed circuit boards, recycled polypropylene was used as continuous phase.

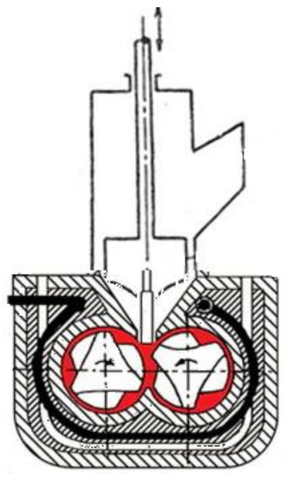
Materials and methods

Types of waste equipment used in the study

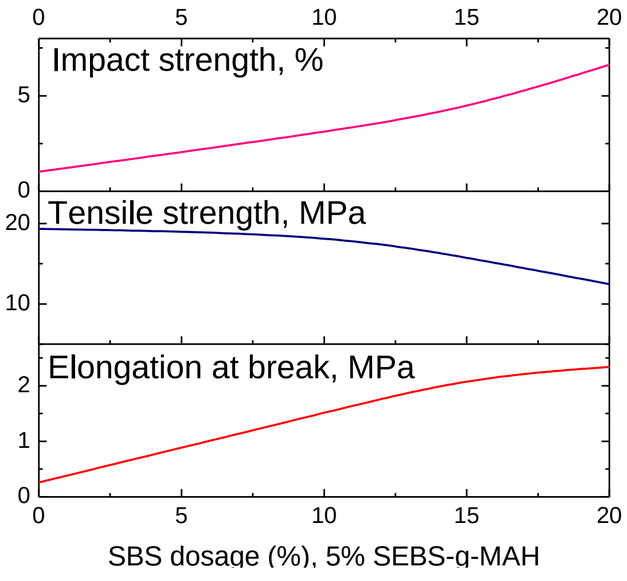


Identified polymers into the waste

SBS
SEBS-MA



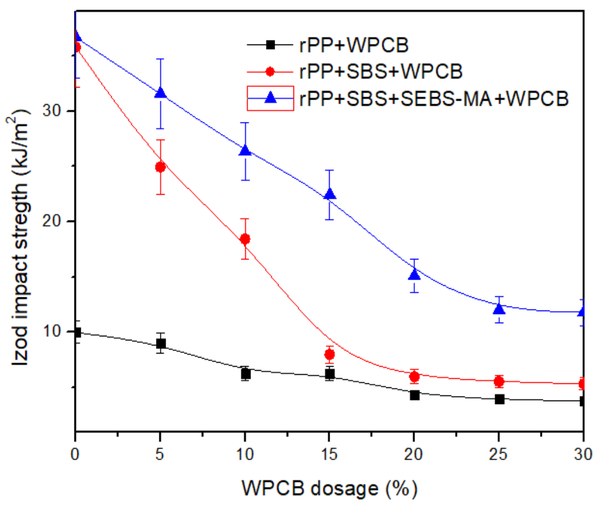
Melt processing of the modified waste

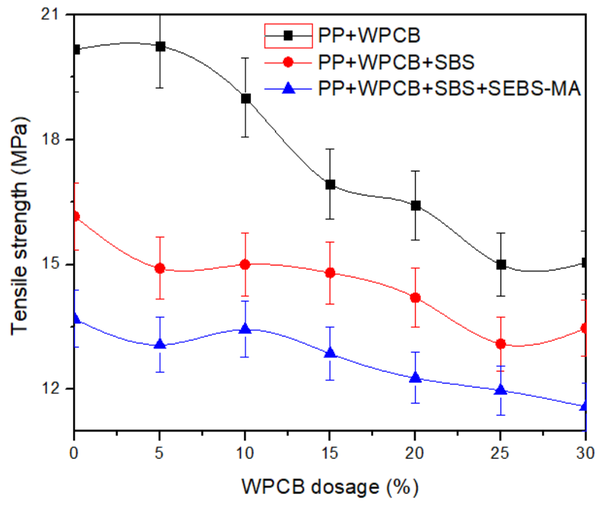


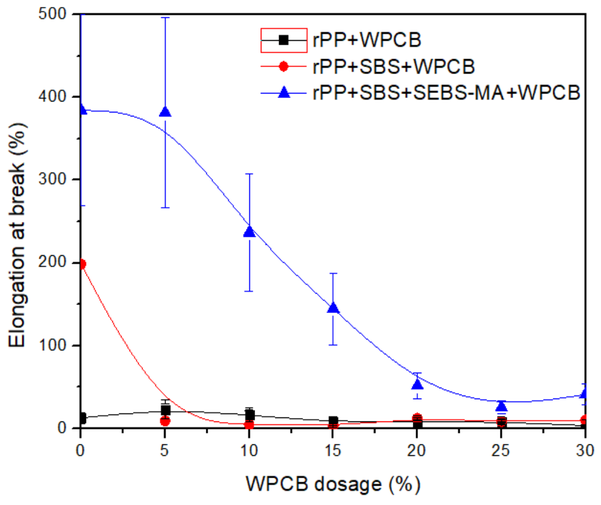
Leaching

H_2SO_4
$CuSO_4$
NaCl

Printed circuit boards (PCB) → Dissolution → Copper removal → Desolvation → Grinding → Waste PP and PCB composites



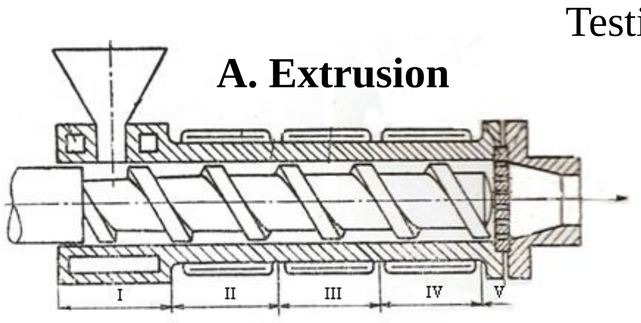




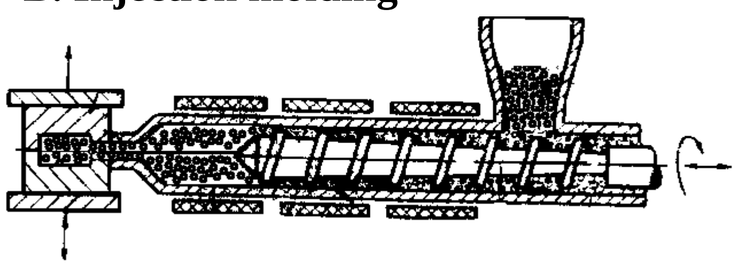
Abbreviations:
PS - polystyrene;
ABS - acrylonitrile butadiene styrene;
HIPS - high impact polystyrene;
Other - polyamides, polycarbonate, etc
SBS - poly(styrene-butadiene-styrene)
SEBS-g-MAH - hydrogenated and maleinized styrene-butadiene block-copolymer
rPP – recycled polypropylene

Testing the processability of blends that contained 25% waste by:

A. Extrusion



B. Injection molding



Sample / Property	Tensile stress at break	Tensile strain at break	Modulus	Energy at break	Impact strength
	MPa	%	MPa	J	MPa
WEEE	20.40	18.20	1814.78	9.11	10.39
WPCB	13.04	45.28	639.48	15.38	21.50

The processability of the waste composites was verified by obtaining in suitable conditions of extruded and injected items. Their aspect was homogeneous, without surface defects and with high mechanical properties.

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