Universitatea *Transilvania* din Braşov

HABILITATION THESIS

SUMMARY

Title: Obtaining, characterisation and applications of polymeric materials based on secondary raw materials

Domain: Materials Enginering

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The present habitation thesis represents a synthesis of scientific and academic activity in the field of materials science and engineering for the period between 1998 and 2017, after the public defense in December 4, 1998 of the Ph.D. thesis with title "*Contributions on thermomagnetic heat treatments of tool steels*". The goal of this habilitation thesis is to obtain, characterise and propose new applications of polymeric materials based on secondary raw materials. Research is focused on polyolefins, as they are the highly-used polymers.

In this respect, chapter 1 ***Obtaining of the secondary polymers*** presents the overall framework of the FP7 project *Magnetic Sorting and Ultrasound Sensor Technologies for Production of High Purity Secondary Polyolefins from Waste,* which was the basis for funding an important part of my research activity. It also shows the trends in the field of polymeric waste management in the Brasov area.

Chapter 2 ***Characterization of the polyolefins as secondary raw materials*** presents different methods for polyolefins´ characterisation such as: gravimetric analysis, image analysis, infrared analysis, mechanical analysis, determination of material crystallinity, determination of contact angle, determination of roughness by atomic force microscopy, qualitative determination of water vapours adsorption from the atmosphere, determination of adsorption of water, microbiological tests, measuring of the heat of combustion (calorific value).

Chapter 3 ***Improving the quality of the secondary polyolefins using magnetic density separation*** presents a new equipment and the related technology to separate the polyolefins using a magnetic fluid, because both PP and PE float in water and it is difficult to separate one from the other. This emerging technology is called Magnetic Density Separation (MDS). For industrial implementation, is required a feasibility study, to allow the owners to decide the opportunity of this equipment with increased capacity. The feasibility study provides all data necessary for the investment decision. Separation of plastics waste using MDS technology with magnetic fluid allows different immersion depth for different type of polymers; it is of great importance the determination of the acoustical properties of polymeric materials (longitudinal ultrasounds velocity). The results can also be found.

Chapter 4 ***Application of the secondary polyolefins in composites materials*** presents the possibilities to improve the polyolefin waste using it in composites materials with different types of composition. Polyolefins composite materials domain is very large due to the multiple combination possibilities that have developed over the years. The possibility of replacing in specific applications the virgin polyolefins from composites materials by second raw materials coming from polymeric wastes is of real interest. Glass fibre reinforced polyester composites (GFPCs) are currently used in a plethora of applications such as construction structures, automotive covers, boat hulls, blades for wind turbines and so forth. Thus, studies regarding the influence of UV radiation on the GFPCs structure and properties under prolonged exposure are of outmost importance. Results are available in the chapter. Because the composite materials can be used in applications requiring mechanical friction, this chapter presents determination of static coefficient of friction on flat surfaces. The selection of polymeric composites from waste as materials for sliding components of machines and devices is a very important aim for tribologists as well as tribological behaviour of non-polymer-on-polymer tribosystems. The best tribological combination practically confirmed is steel on polymer; therefore the tests were done with this system.

Chapter 5 ***Polymers moulding*** presents two applications of polymer flow inside mould in order to study the influence of shape on the technological and stress results. Results concerning the study of the influence of shape on the material consumption, part deformation and injection time are presented.

Proposals for further research are based on the two subjects related to materials engineering, especially materials for environmental protection, introduced in the first five chapters: new materials for environmental protection with photocatalytic properties and composite materials from secondary raw materials.