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CONSTITUTION OF USEFUL PROPERTY OF COMPOSITE MATERIALS

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Abstract

In the thesis some problems concerning fabrication of composites based on present knowledge and author's own experience have been revealed. The methods of fabrication of the composites take into consideration following operations like size-reduction, agglomeration and compounding (mixing components) in solid (grainy) state to obtain the composite of determined properties assigned for processing operations like injection moulding, extrusion or press moulding.

Keywords*: grainy materials, rubber powder, mixing, composites*

1. Introduction

Production of materials from polymer about required properties joins mostly with selection of suitable polymer materials (more and more often of composite materials – obtained from waste material "thermoplastic materials" and waste material "rubber") also selection of proper methods of processing [1-5]. Processing of composite materials will demand complex interlocking in technological process of each composition process [4-6]. The principle problem from scientific point of view and utilitarian are prospecting of conditions connected with constitution required proprieties of composite materials also qualification of conditions processing these composites in aspect their uses in practice [7-9].

2. Aim of this paper

Aim of this work is present idea permiting on qualification of conditions constitution of composite materials in technological process, aim of receipt of products from materials about given properties and definite qualities. One accepted argument, that exists one profitable harvest of composition process constituting properties needs will be this injection, extrusion or pressing) of composite materials (produced from waste material "foil" and rubbers) and that are special manners of their realization (for example characteristic conditions of process agglomerating-plant of foil, of crumbling for rubbers and mixing) which proper selection will be decide about qualities

of products received from these materials. Basing on the literature study, preliminary research in industry [10,11] and a long-term international co-operation [6,12-14] and especially with the Technical University of Chemnitz/Germany, composition processes were developed (see Table 1). These are:

- Process of crumbling of input – materials (connected from them such problems how obtainment reproducible of fraction, estimation of size and of shape and of external surface of elementary grains),
- Process of mixing of input – materials (in solid state constants - about figure of grains) and of additional components (often also about grainy figure) and estimation of degree level of mixed composite materials with methods direct or indirect,
- Process of processing principle obtained of composite materials (in dependences from needs will be this injection, extrusion or pressing).

In Table 1 (column 1) one seized in synthetic manner these composition process, which in essential manner can influence on proprieties of useful composite materials. From table results, that condition rational elaborations in wanted solutions is nearer recognition replaced of composition process, which qualitatively would qualify influence select factors constructional-technological (appointed in column 3 embracing for example kind, dimensions of material crumbled and mixed), described by functions of object of researches, on physical sizes qualifying effectivity suitable composition process (appointed in table 1 in column 2, as measure). Will demand this so uses and leadership proper researches methods.

Tab.1. Summary composition of composition process constituting properties of composite materials [4,6,7,9,13,14]

Name of composition process		Measure qualifying effectivity of composition process	Technological-constructional factors essential for composition process
1		2	3
A Agglomerating-plant	OB I	torque M_o, force of cut: F_c	M_o, F_c = f(a_1, a_2…….a_n
B Crumbling	OB II	torque M_o, force of cut: F_c	M_o, F_c = f(a_1, a…….a_n)
C Mixing	OB III	power N, time t_m, level of mixed M_m	N, t_m, M_m = f(b_1, b_2,.....b_n)
D Process of processing (pressing, injection, extrusion)	OB IV	pressure p_p, time t_p of pressing	p_p, t_p = f(c_1, c_2 ..... c_n)
E Verification of researches	OB V	Tensile strength R_m, level of mixed. M_m	R_m, M_m = f(V_1, φV_n,.....φ$_n$)
F Other	OB N	……	Ψ, Φ = f (x_1, x_2 …….x_n)

3. Experimental part

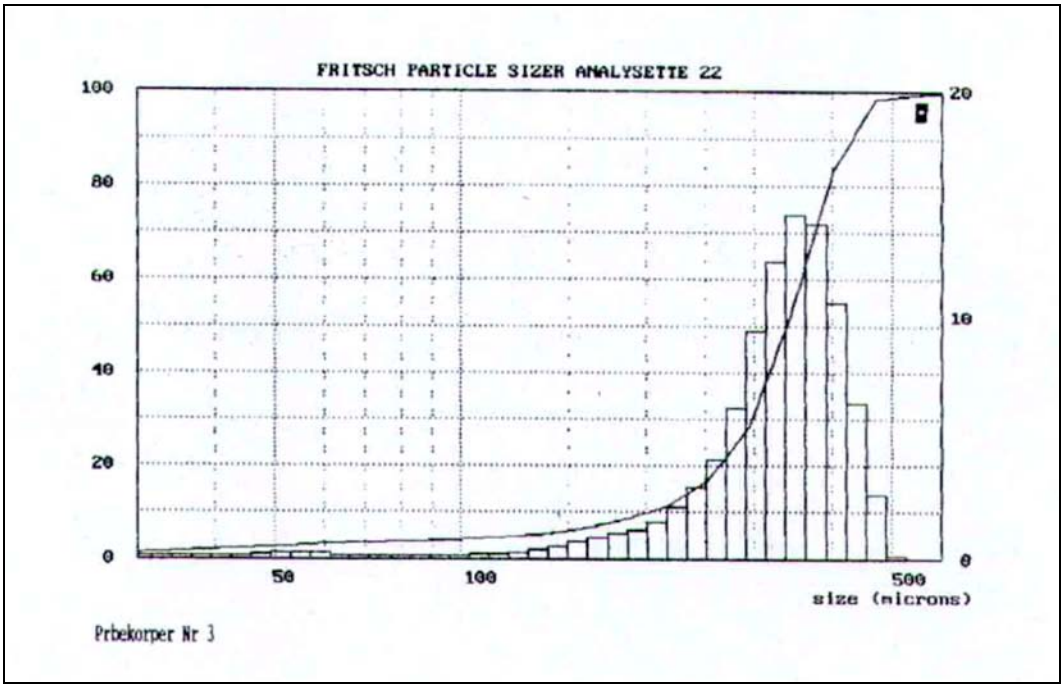
To reach founded aim of work one passed research laboratory basing on program of researches, using following materials

- from recycling (agglomerate) polythene (PE-LD) about grain class equal 1.0 mm:

- crumbled waste material rubber (about nearing proprieties to practical Tyres of vehicles of rubber type SBR) about grain classes given below.

On suitable position research [12, 14], one crumbled waste material of rubber, with aim of obtainment of suitable grain classes. In result passed strainer analysises in (accordance to PN-71/C-04501) one obtained rubber powder about following grain classes: 0.2; 0.4; 0.6 and 0.8 mm. On Fig. 1 one showed of for example distribution curve grain for different classes grain rubbers. btained fractions of rubber powder one added (in masses) according to material from recycling in following quantities: 5, 10, 15, 20 and 25%.

a)



b)

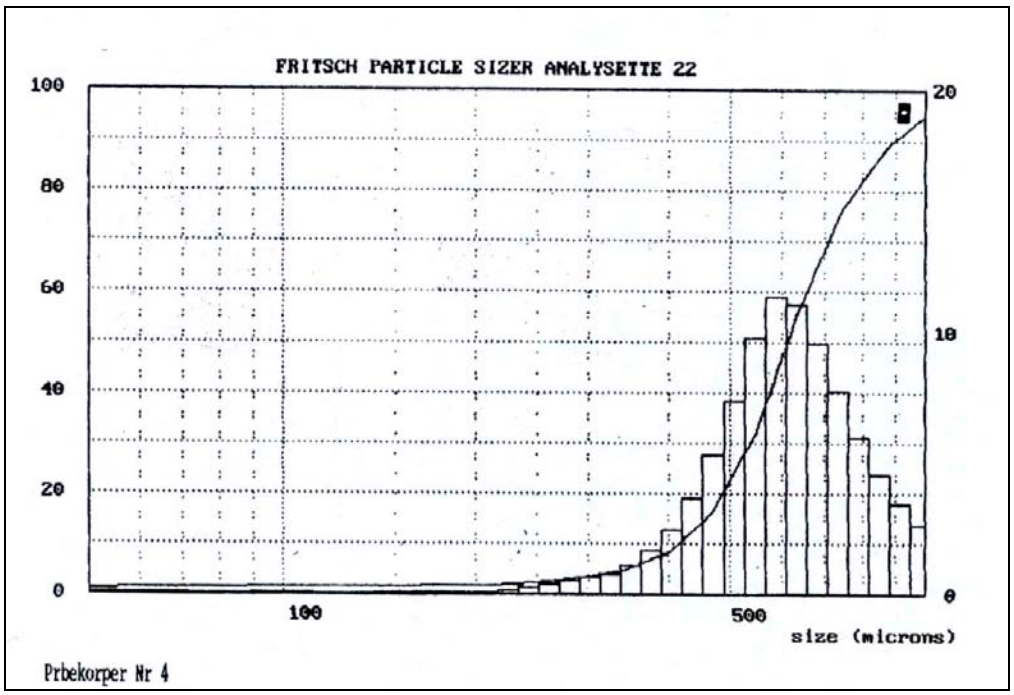


Fig. 1. Example- distribution curve for grain classes 0.4 (and) and 0.6 mm(b)

Process mixings of components in state solid and estimation of quality of process mixing one realized according to provided for procedures in description of position research [13, 14], with utilization of computer programmer COREL PHOTO-PAIN. Received samples at random according to literature [9], one subjected to estimation of degree confusions(with immediate method) showed proprieties of mixture nearing two component to homogeneous [10,11]. From replaced received at random samples composite one executed with method of injection and of pressing pressure – according to C (tab. 1) samples about standardized shapes and dimensions to researches strength with aim of verification of mechanical propriety according to D (tab. 1). Results of researches of influence suitable grain classes (0.2; 0.4; 0.6; 0.8) and contents of rubber powder V[%] in recycling PE-LD on endurance on extension one represented graphically on Fig. 2 and 3.

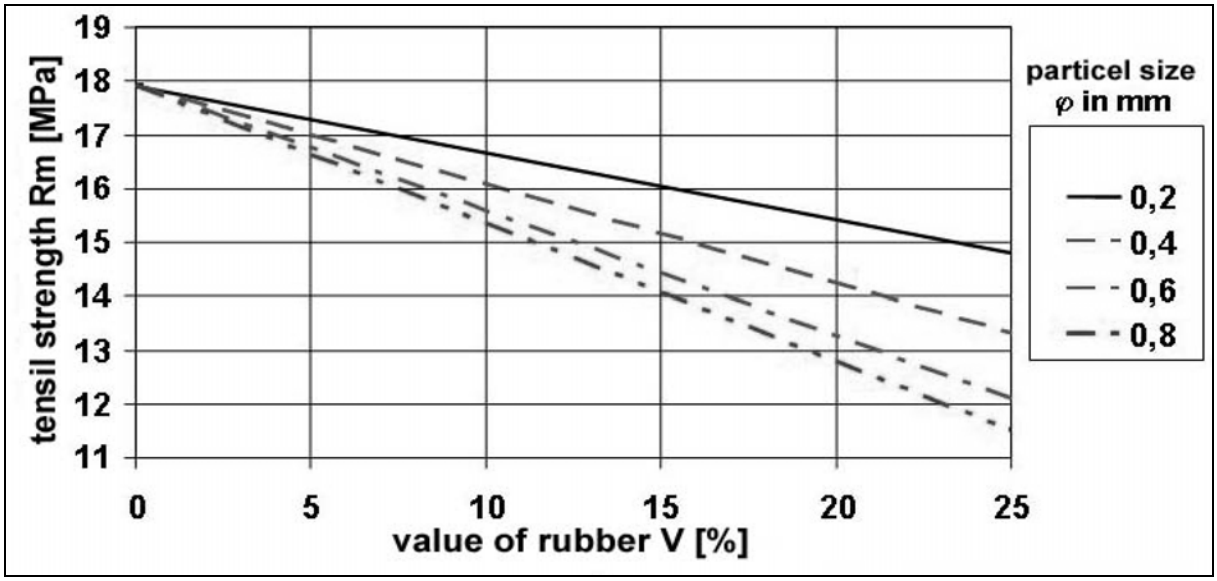


Fig. 2. Influence contents of rubber powder V[%] and sizes of grains(φ = 0.2; 0.4; 0.6 and 0.8 mm) on endurance on extension Rm [MPa] – for pressing

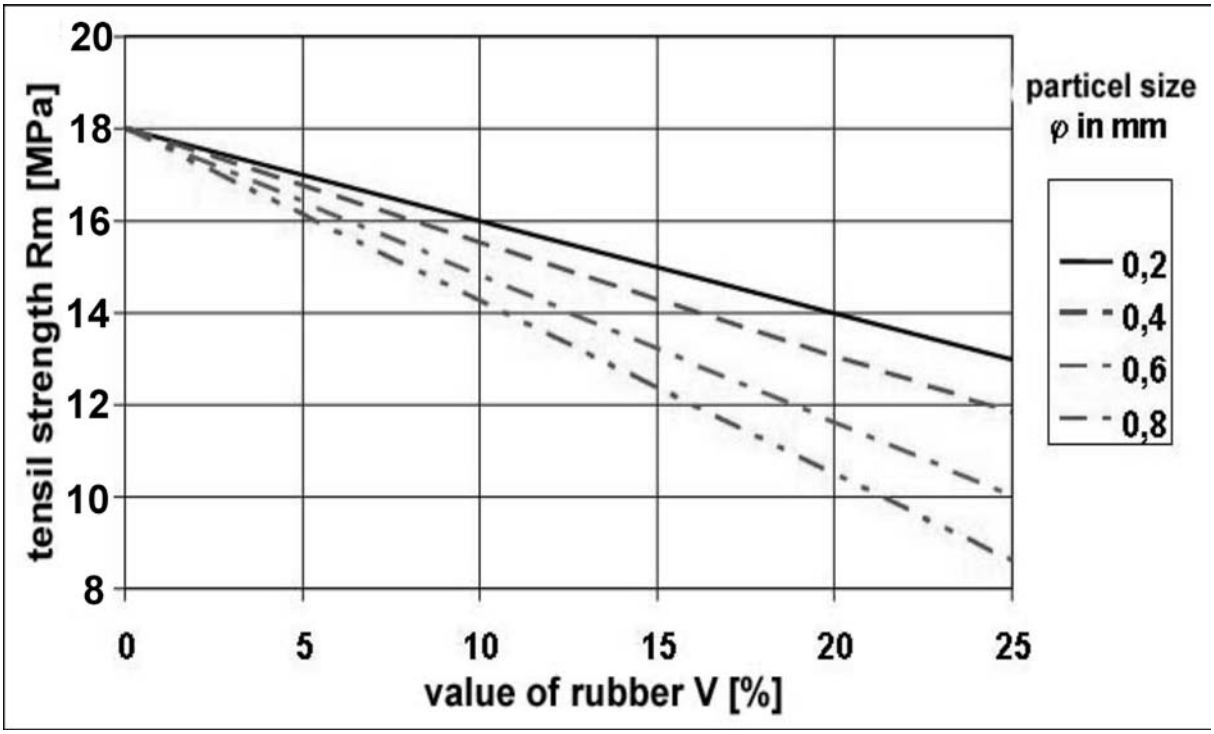


Fig. 3. Influence contents of rubber powder V[%] and sizes of grains(φ = 0.2; 0.4; 0.6 and 0.8 mm) on endurance on extension Rm [MPa] – for injections

Analysing nearer courses of each function one can notice, that essential influence on research feature in section from 0 to 25% has manner of preparation of samples, of melting's of crumbling and content of powder in recycling. prepared Samples by pressing show considerably higher values than injected. However fall of strength is not similar- identical for all of grain classes. Interesting is that least fall one can notice for composite in all section of content powder rubber for grain classes equal 0.2 mm.

This will create possibility of minimalizing fall of strength by using of rubber powder about dimensions below 0.1 mm. Use in future researches and uses of rubber powder on level sub-micro(10^{-6}) or most profitably on level nana(10^{-9}) will permit probably to obtain composite about unparalleled to this times proprieties chemical-physics [2,6-10]. As goes for fall of tensile strength for remaining grain classes (composite with participation of powder about dimensions 0.4; 0.6 and 0.8 mm) this is more considerable to greater in content. On all observed microstructure, in this also for example shown on Fig. 4 one can notice comparatively little adhesion among warp (PE-LD) and with interpolations (grains of rubber) - refers this especially microstructure shown on fig. 4c and of fig. 4d.

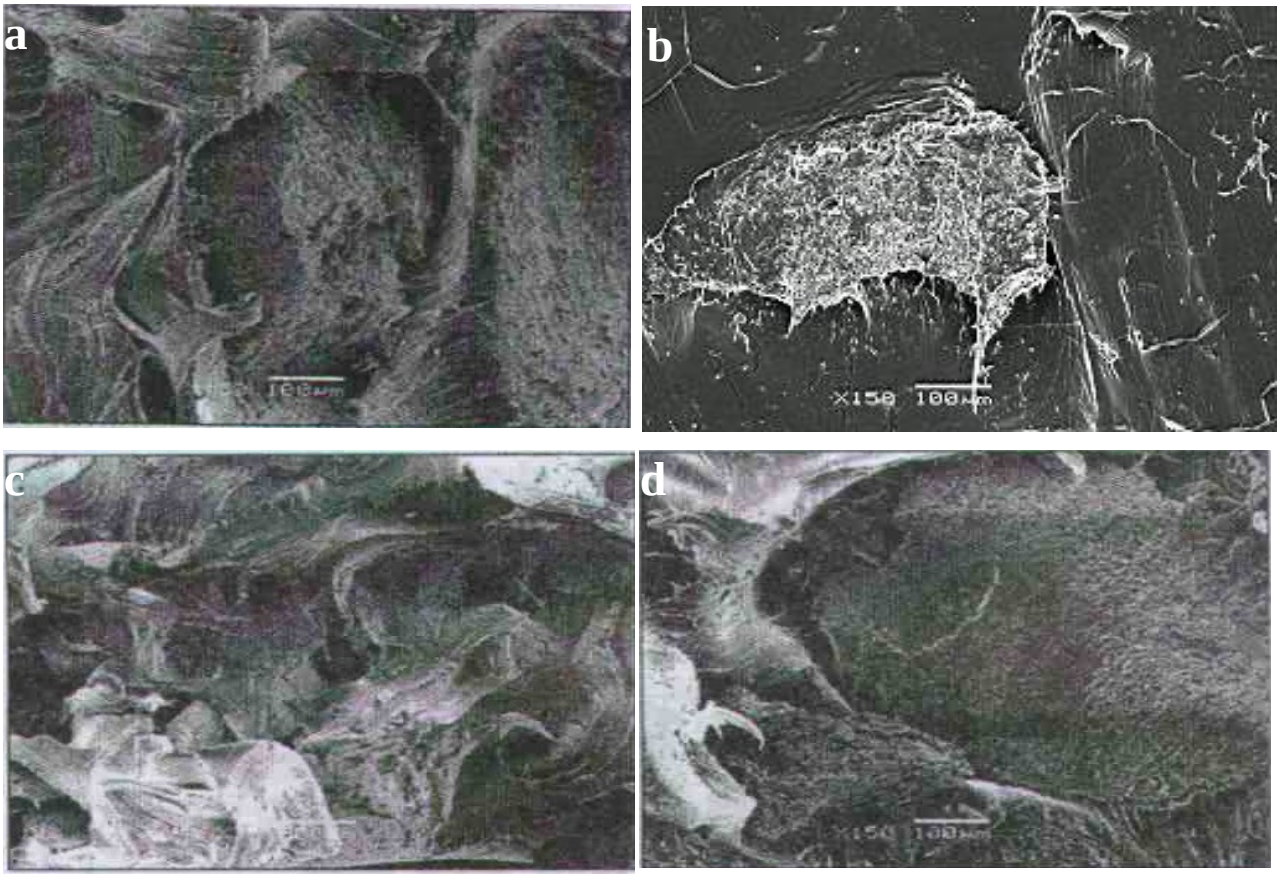


Fig. 4. Microstructure turns of samples about different contents and to class grain rubber powder: And – 10% of rubber powder about class 0.4 mm, b- 20% and 0.4 mm, c – 10% and 0.8, d – 20% and 0.8 mm

This observation will demand of however further researches especially in range of measurement of adhesion on border: polymer material – grain of powder. Research should be so realized with regard of wider section of classes grain and greater contents of rubber powder

4. Conclusions

There were no procedures to analyze the fabrication of composites made of thermoplastic film wastes and rubber wastes in connection with properties of components in solid (grainy) state

before compounding and press moulding by now. Because of specific basic operations the tests were carried art on special test stands using phenomenological methods. The results have enabled determination of the most advantageous directions for designing technological lines within the range of utilization of selected plastics and rubber wastes. The results might also be used for designing other constructional-technological solutions which would concern fabrication of composites based on other secondary polymeric materials.

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