SYNERGIC EFFECTS AND ADHESION BETWEEN GLASS TEXTILES AND EPOXY/RESIN

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The mechanical properties of the prepared composites probes made with epoxy resin matrix reinforced through glass webs have been measured for the estimation of so called synergic index defined in the paper.

In dem Artikel sind verarbeitet die Messungen mechanischer Eigenschaften von Kompositen mit Epoxid-Matrize die versteift sind durch Glas-Gewebe. Aus diesen Messungen wurde der synergische Koeffizient (Index) errechnet, der in dem Artikel definiert ist als eine Grösse, die gegenseitige Wirkung der Textilie und Matrize bestimmt.

Обработаны измерения механических свойств композиционных материалов с эпоксидной матрицей армированной стекляной тканью. На основе измерений вычислен коэффициент синергизма (индекс), определяемый в статье как величина, определяющая взаимодействие текстильного материала с матрицей.

V článku jsou zpracována měření mechanických vlastností kompozitů s epoxidovou matricí vystuženou sklovou tkaninou. Z měření byl vypočten součinitel (index), který je v článku definován jako veličina určující vzájemné působení textilie a matrice.

There is well known fact that the mechanical and other properties of the textile composites are determined by the relative contents of the reinforced textiles and matrix. For the proposing of the optimal properties of these composites it is necessary to know the synergic effects and adhesion between the constituents of composites.

For the estimation of synergic effects and adhesion the samples with different content of epoxy-resin coated on the plain glass woven has been prepared so that it has been done to the disposition the whole scale of 21 textile composite samples made from the free plain glass woven to the pure resin ones. The content of the epoxy-resin lain on the glass plain woven has been measured through the surface (area) mass in (g/m^2) of the resin in composite, which has been moved from zero to the 190 g/m^2. The epoxy-resin of the typ CHS Epoxy 1 200 hardened with the P 11 hardener and dissolved in the toluen has been used. The epoxy-resin has been applied in the dissolved form in the toluen in the glass woven. The correlation curve between area mass of epoxy-resin with the ratio dilution is presented in fig. 1. The correlation curve is from zero aproximately to 100 g/m^2 (10 : 4 epoxy-resin : toluen) lineary and then rises nonlineary.

From the textile composites the samples for the mechanical tension experiments has been prepared and mechanical properties of the samples in the dependence on the contents of epoxy-resin for the three textile orientation to the tensile direction have been measured. These three direction have been choiced

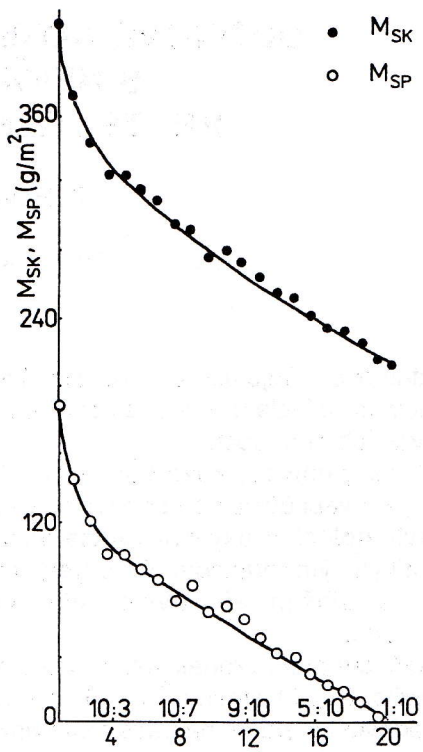

Fig. 1 The correlation curve on the ratio dillusion of epoxy-resin in toluen

in the warp (L), werf (T) and 45° direction between warp and werf directions. From the mechanical tensile measurements the dependence of elongation AH at maximal forces at FH, the work (energy) of deformation FΔA on the surface area M_S of the epoxy-resin

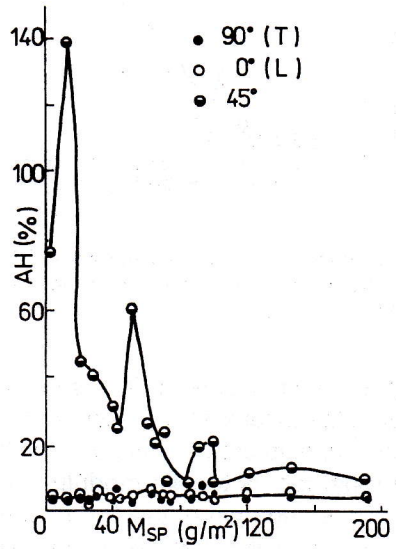

Fig. 2 The dependence of elongation AH at maximal forces on the composite

content for the three orientation of plain woven L, T and 45° to the tensile direction have been plotted. These dependences are represented on the fig. 2,

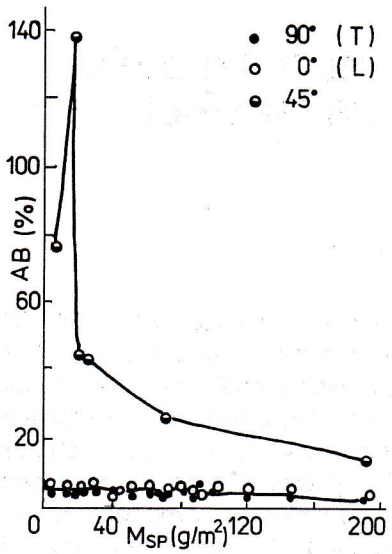

Fig. 3 The dependence of the relative elongation AB on the area mass of the composite

3, 4, 5, 6, 7. From these figures it is evident that quantities AH (fig. 2) and AB (fig. 3) show the significant changes in dependence of area mass of the epoxy-resin content only at the 45° orientation, while in the L and T orientation remains constant. In the force dependence FH and FB there is created the contrary situation, the dependence for the 45° orientation is low and approximately meanwhile the forces

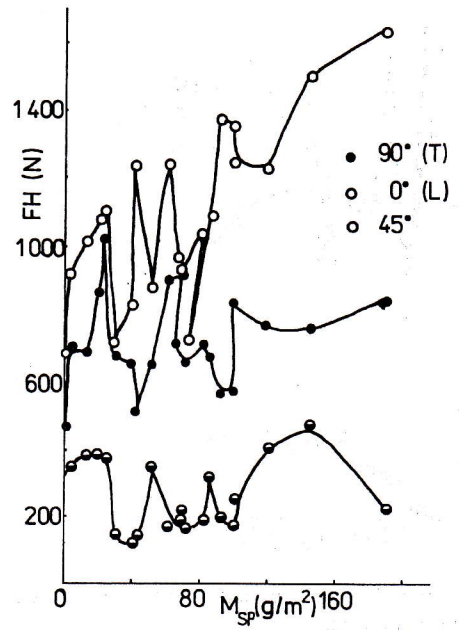

Fig. 4 The dependence of the maximal forces acting on composite on the area mass of composite

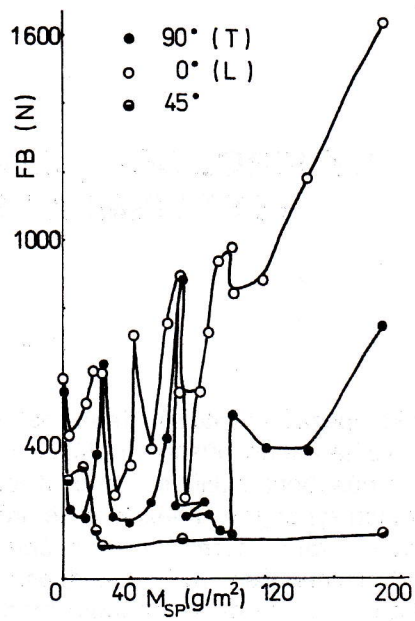

Fig. 5 The dependence of the force FB acting on composite on the area mass

FH and FB for L and T orientation increases (fig. 4,5). For the dependence of the Young modulus on area mass of epoxy-resin content the situation has been developed as follows from the fig. 6. For the orientation L and T the monoton (oscilating) dependence has been found, but for the orientation 45° doas the Young modulus slowly increase with the increasing area mass epoxy-resin content in composites. The same can be observed for the tensile work FA, which increases also with increasing of the area mass content of epoxy-resin content.

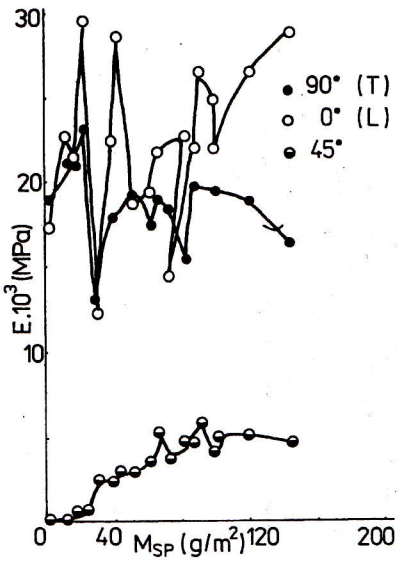

Fig. 6 The dependence of the Young modulus E on the area mass of the composite

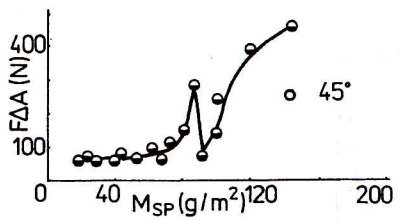

Fig. 7 The dependence of the breaking work $F A = W_B$ on the area mass for the 45° orientation of the composite to the direction L (longitudinal)

From these measurements it is shown that there is an advantadge to take as a measure of the synergic and adhesive effects of the textile composites the mechanical properties as tensile modulus, tensile work as well as the elongation of the textile composites in the 45° direction which has been appeared as the most sensitive to the epoxy-resin content in the textile composites.

SYNERGETICKÉ JEVY A ADHEZE MEZI SKLOVÝMI TEXTILIEMI A EPOXIDOVOU PRYSKYŘICÍ

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Při tvoření kompozitů s výstuží je třeba znát a kvantifikovat vliv vzájemného působení vláken v textilii a vzájemného působení textilie s matricí. K tomu byl v článku zaveden synergický index, který je určen poměrem modulu v tahu měřenému pod úhlem 45° vzhledem k význačnému směru (ve směru osnovy nebo útku u tkanin), k maximální hodnotě modulu na zkoušených vzorcích. K tomuto účelu byla připravena sada vzorků vytvořených ze sklové tkaniny s přídáním epoxidové pryskyřice CHS 1 200 (371) od nuly do 100 g/m^2 plošné hmotnosti plošných vzorků. Na takto připravených vzorcích byly měřeny moduly v tahu ve směru osnovy a útku, které vykazovaly největší hodnoty a moduly ve směru 45°. Jejich poměrem byl pak určován synergický modul v závislosti na obsahu epoxidové pryskyřice. Vynesená závislost je rostoucí z prvu lineárně a později dochází k jejímu nasycení.