# Stabilization of Hybrid Prepreg Composite Tapes for Industrial Applications

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## ABSTRACT

Glass fibers are known to have good mechanical properties enabling its usage for reinforcement of composites. In this study, hybrid composite tapes containing resins with different fillers were prepared and treated with plasma. Their tensile properties were investigated. The results showed that the prepared tapes were durable with increased shelf life for long-term storage.

## INTRODUCTION

Glass fibers are known for their nonflammability, strength, abrasion resistance, cost effective processing and reasonable price. Glass fabrics are produced using multifilament yarns. The filaments are glued together (roving yarn) into tape shapes (tows) to ensure compactness and improved properties (strength, evenness) [1 - 7]. Spread Tow Tape (STT) is characterized by the fact that more than 3 times the diameter of the original multifilament multiply their width.

The stabilized hybrid composite tape consists of uncoated and coated glass multifilaments (E-glass, 1310 fibers) parallelized to the direction of the belt axis was used. Preparation of prepregs was carried out in a pilot plant built by Večerník s.r.o. company, Liberec, Czech Republic. The tensile properties was measured by Instron with clamping length of 200mm and strain rate of 0.25/min, a tape thickness of 0.16mm (differences without epoxy) and a width of 4mm. Dynamic mechanical analysis test was carried out in dynamical mechanical analyzer DMA DX04T. Fiber properties were measured in Vibrodyn 400 instrument. The aging test was done in Atlas weathering instrument at 80 deg, C 65% RH for 24 hrs in VUTS, Czech Republic.

## RESULTS AND CONCLUSION

The dynamic elastic modulus of ash-filled composites improves over the entire temperature range compared to the uncompleted composite. A significant effect of the flyash on the dynamic elastic modulus is demonstrated. Mechanical tests and dynamic mechanical analysis were used to select a suitable filler and its concentration. Based on these tests, 2.5 % by weight of fly ash particles was chosen as optimal with respect to the combination of improvement of mechanical. While it is not the best in terms of the dynamic elastic modulus but with the inclusion of static mechanical characteristics and impact characteristics as a suitable compromise. Figure 1 shows the dynamic thermomechanical analysis of all samples. Different composition of fillers in samples had different relation of elongation-maximum force. Effect on samples filled with fly

ash and filled with graphite did not have much difference in elongation percentage indicating that samples with fillers have lower effect on it. The ratio of force to elongation is greatly increased when sample with graphite was compared with one without fillers, indicating that the content of graphite influences its tensile properties. The aged samples with different fillers decreased in its ratio of force to elongation compared with corresponding samples without aging treatment, and the percentage decrease in elongation of samples without fillers. As can be seen from the figure, samples with both of aging and plasma reduced at both maximum force and elongation compared with untreated samples.

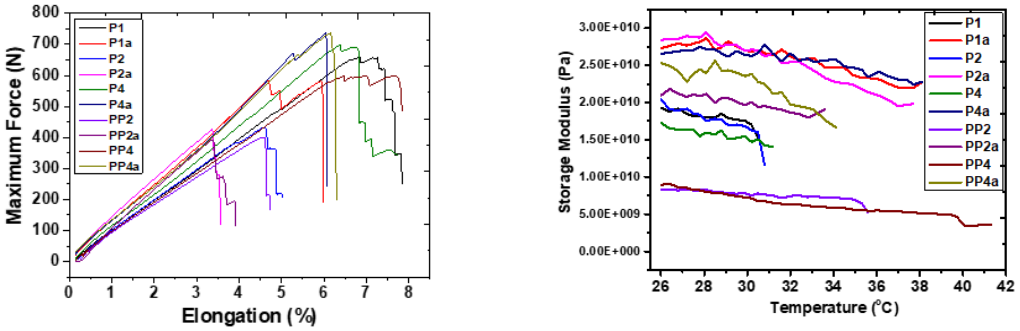


Figure 1. Force-elongation and Storage modulus

In this work, advanced glass fiber-based tapes containing special epoxy resins in pre-condensate was prepared. Mechanical properties was enhanced by adding suitable type of nanoparticles in the resin, which showed a significant difference between the samples. It was found that the loss of mechanical properties was not significant for the samples before and after weathering, which indicated longer storage life. The main advantage of this study was the optimization of tape geometry and maximum use of tow filaments strength and enhanced durability for long-term storage of tapes.

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