

## The Effect of a Reactive Poly (2-Vinyl-2-Oxazoline) Monolayer of Carbon Fiber Surface on the Mechanical Property of Carbon Fiber/Polypropylene Composite Using Maleic Anhydride Grafted Polypropylene

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**Abstract :** Carbon fiber reinforced thermoplastic resin using short carbon fiber has been produced by melt mixing and the improvement of mechanical properties has been frequently reported up to now. One of the most frequently reported enhancement has been seen in carbon fiber / polypropylene (PP) composites by adding small amount of maleic anhydride grafted polypropylene (MA-g-PP) into PP matrix. However, the further enhancement of tensile strength and tensile modulus has been expected for lightening the composite more. Our present research aims to improve the mechanical property by using a highly reactive monolayer polymer, which can react with both COOH of carbon fiber surface and maleic anhydride of MA-g-PP in the matrix, on carbon fiber for PP/CF composite. It has been known that oxazoline has much higher reactivity with COOH without catalysts, compared with amine group and alcohol OH group. However, oxazoline group has not been used for the interface. To achieve the purpose, poly-2-vinyl-2-oxazoline (Pvozo), having highly reactivity with COOH and maleic anhydride, has been originally synthesized through radical polymerization using 2-vinyl-2-oxazoline as a monomer, resulting in the Mw around 140,000. Monolayer Pvozo chemically reacted on CF was prepared in 1-methoxy-2-propanol solution of Pvozo by heating at 100°C for 3 hours. After this solution treatment, unreacted Pvozo was completely washed out by methanol, resulting in the uniform formation of the monolayer Pvozo on CF. Monolayer Pvozo coated CF was melt mixed with PP and a small amount of MA-g-PP for the preparation of the composite samples using a batch type melt mixer. With performing the tensile strength tests of the composites, the tensile strength of CF/MA-g-PP/PP showed 40% increase, compared to that of CF/PP. While, that of Pvozo coated CF/MA-g-PP/PP exhibited 80% increase, compared to that of CF/PP. To get deeper insight of the dramatic increase, the weight percentage of chemically grafted polymer based on CF was evaluated by dissolving and removing the matrix polymer by xylene using thermogravimetric analysis (TGA). The chemically grafted remained polymer was found to be 0.69wt% in CF/PP, 0.98wt% in CF/MA-g-PP/PP, 1.51wt% in Pvozo coated CF/MA-g-PP/PP, suggesting that monolayer Pvozo contributed to the increase of the grafted polymer amount. In addition, the very strong adhesion by Pvozo was confirmed by observing the fractured cross-sectional surface of the composite by scanning electron micrograph (SEM). As a conclusion, the effectiveness of a highly reactive monolayer Pvozo on CF for the enhancement of the mechanical properties of CF/PP composite was demonstrated, which can be interpreted by the clear evidence of the increase of the grafting polymer on CF.

**Keywords :** CFRTP, interface, oxazoline, polymer graft, mechanical property

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