

Evaluation of the peel ability between the carbon fiber prepreg sheet and the release paper

Point: The evaluation of the peel ability becomes more apparent by the use of a high-speed peel test close to the actual usage environment.



Keywords: High-speed peel test

Versatile Peel Analyzer - VPA-3

Background

Carbon fiber prepreg is a sheet-like material in which carbon fiber is impregnated with resin and is used in a wide range of fields as an alternative material to metal because it has excellent features of lightweight, high strength, and high rigidity. In addition, very high safety requirements must be met for the manufacture of aircraft fuselages and main wings.

The prepreg laminate is formed by an automatic device equipped with a prepreg laminate head, which peels off the release paper from the prepreg's surface, laminates the carbon sheet, and winds the release paper onto the take-up reel. Furthermore, the laminate head performs these three processes at the same time. The easy-peel property is an essential factor in the smooth operation of the prepregs lamination process. Patents report peel strengths of 0.7 to 3.0N/25mm.

Problems to be solved

The peel properties of three types of release papers A, B, and C were evaluated, but the evaluation results and the peel strength in the laminating device were different. Since the laminate head operates at a 30m to 60m/min speed, we would like to evaluate the peel rate and peel angle under operating conditions.

The restricted peel rate of max 1.000mm/min and the lack of adjustable peel angles of conventional testing machines make them inappropriate to evaluate the peel properties under normal conditions of use.

Measurements and results

We used our Versatile Peel Analyzer model VPA-3 under the following conditions:

- Condition 1:
Peel rate: 1,000mm/min, peel angle: 180°
- Condition 2:
Peel rate: 30,000mm/min, peel angle: 45°

The results showed that the peel strength of condition 1, similar to conventional measurement conditions, was higher in C > A > B. Still, the peel strength order of condition 2, set under almost the same conditions as the prepreg laminating device, was A > C > B and matched the peel strength ranking of the laminating apparatus.

Schematic of the automated prepreg lay-up process

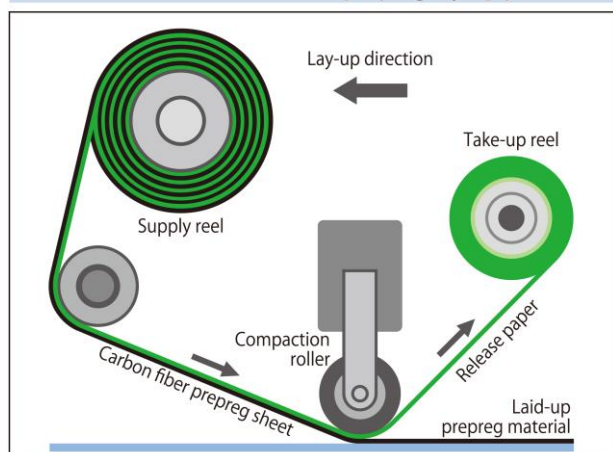


Figure 1 – Schematic of the prepreg lay-up process

Furthermore, if the peel strength is too small, the prepreg and the release paper will peel off before use, and if the peel strength is too high, the silicone will adhere to the prepreg, a cause for laminate failure. Therefore, it is necessary to always manage to the optimum state.

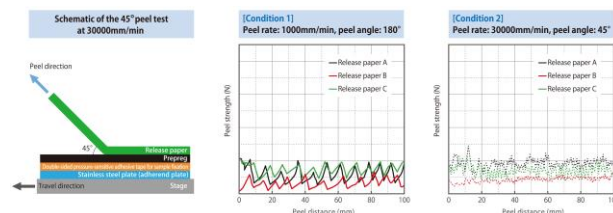


Figure 2 – Schematic of the 45° peel test and comparison charts of the test results

Conclusion

Our VPA-3 is suitable for evaluating peel strengths under actual usage conditions for best reliability and to ensure product quality.