

## TORAYCA® Prepreg Matrix Resins (#2573, #2574)

Toray developed new matrix resins #2573 and #2574 by applying the NANOALLOY® technology that permits nano-scale phase separation of two or more types of resins.

Under this technology, the types of combined resins, curing agent and curing conditions are optimized to cure the resins in a state of homogeneous mixture, to control the phase-separated cured resin structure at nano-scale level. Given the trade-off relationship between the modulus and fracture toughness of resin, it has been difficult to improve the modulus of resin while maintaining its toughness. However, by applying its NANOALLOY® technology Toray has successfully combined these heretofore mutually exclusive characteristics (Figure 1, Figure 2).

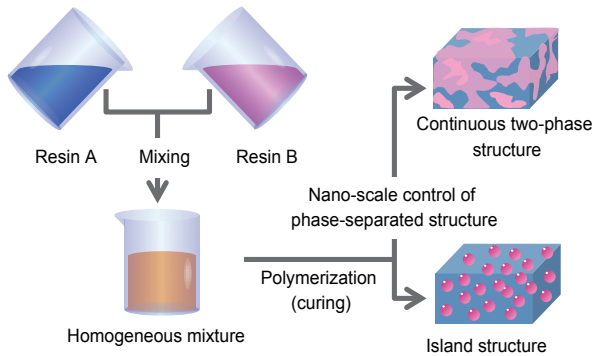


Figure 1. NANOALLOY® technology in matrix resin

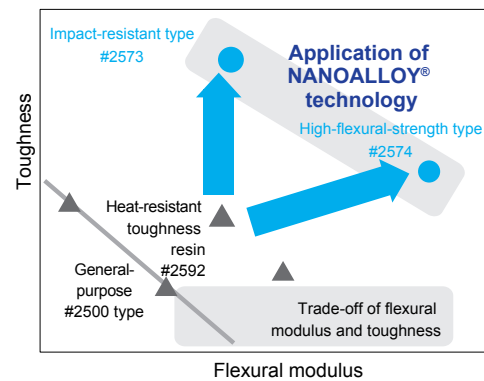


Figure 2. Physical properties of NANOALLOY® applied resins

### #2573 resin: Impact-resistant

#2573 boasts far greater toughness compared to the existing heat-resistant tough resin #2592 while maintaining the same modulus of #2592; as a result, the #2573 composite exhibits 14% higher Charpy impact strength. When the load vs. strain curves of the two resins are compared, both behave identically until the maximum load, after which the #2573 resin composite shows a significant increase in energy absorption (Figure 3, Figure 4).

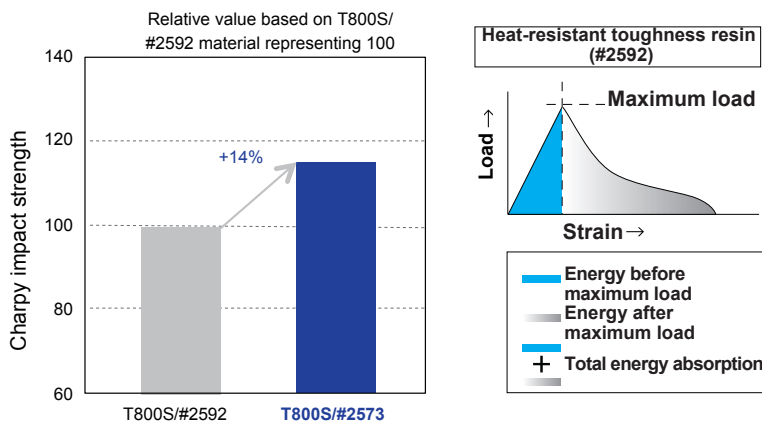


Figure 3. Charpy impact strength of impact-resistant NANOALLOY® #2573 (Total energy absorption of flat plate)

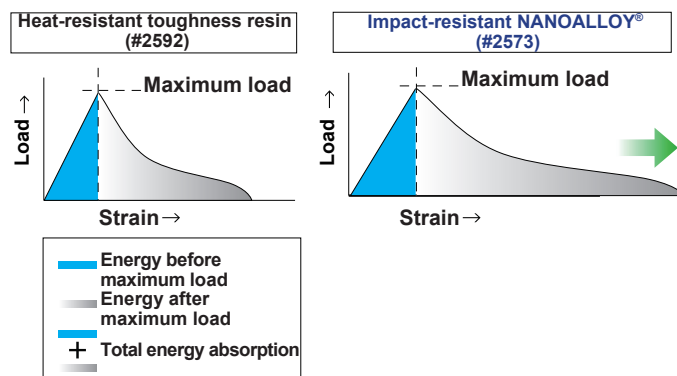


Figure 4. Image of Charpy impact strength chart

### #2574 resin: High-flexural-strength

#2574 boasts far greater modulus compared to the existing heat-resistant toughness resin #2592 while maintaining the same toughness of #2592; as a result, significantly higher flexural modulus can be expected while maintaining torsion strength of cylinder composites, which is ideal in applications as golf shafts.

Furthermore, the composite combining #2574 resin with the TORAYCA® T1100G fiber offering high-strength and high-modulus carbon fiber, achieves 13% higher strength and 10% higher modulus compared to the conventional resin (Figure 5).

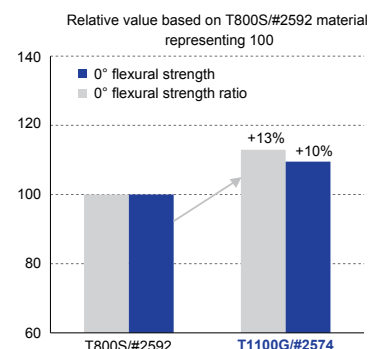


Figure 5. Physical properties of high-flexural-strength NANOALLOY® #2574 composite