Glue Busters II: The Effects of Accelerated Cure Time on the Ultimate Shear Strength and Efficiency of CA and PVA Glue

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This project studied the effects of accelerated cure time for CA and PVA glues. I tested the ultimate shear strength (USS) of 120 cross-grain lap joints over 6 weeks and then compared the findings with last year's results where the glues were cured naturally. This year, I used a chemical accelerator on the CA glue joints and 24 hours of heat (35°C) on the PVA glue joints. For testing, I used the same brace and table that I designed and built last year. The brace kept the joints from flexing and made sure the joints experienced shear stress as force was applied. The table allowed sand to flow into a bucket hanging from each joint. A trap door stopped the sand when each joint broke, and I used the mass of the filled bucket to calculate USS. I compared the efficiency of both glues considering the cost, mass and strength produced. Using the data from the strength tests, and the data from last year's experiment on glue evaporation, I calculated the cost of each glue with acceleration. Then, I projected the USS and cost for both glues to make larger joints in a commercial setting assuming they used 1g of accelerated cured glue. The PVA joints with accelerated cure time had the highest USS over time, reached their optimal USS approximately five times faster than if they were cured naturally, and were more efficient (lightest, cheapest, and strongest). The CA joints with accelerated cure time actually weakened over time.

Awards Won:

National Security Agency Research Directorate : First Place Award "Material Science" $1,000