Carbon Fiber in Cars Cheat Sheet

CFRP roof results, barriers and cost outlook

Key equations

Quantity	Equation	Notes
Strength-to-weight ratio	**SWR = strength / weight**	The roof-crush design metric the article uses
Sandwich CFRP roof (optimized)	**Face sheet 0.8 mm; PP foam core 70 kg/m^3**	Cui et al. 2020 [2][8], as cited in the article
Mass reduction	**Up to 68% vs the metal roof**	Met crashworthiness targets [2][8]
VA-RTM process	**Resin pushed into mold by a pressure gradient**	Lee et al. 2019 [4]: voids down about 3%
Energy absorption	**Up to 36% more than a traditional panel**	Bending test of VA-RTM roof [4][7]
Cost	**$10–12/lb today → $5–7/lb projected**	Article's outlook; 17% of vehicle by 2040

Key takeaways

- CFRP = carbon fiber reinforcement in a polymer matrix. About 90% of fiber is PAN-based, the rest rayon or pitch.
- Benefits listed: low weight, high strength-to-weight, efficiency, handling, crash energy absorption, corrosion and fatigue resistance.
- Barriers: cost, hard repair, limited supply, energy-intensive production, poor recyclability, high electrical and heat conductivity.
- Voids at roof corners from prepreg compression molding act as stress risers and can cause cracks and leaks.
- Best near-term fit: exterior closures such as the roof, since a roof adds little structure but noticeable mass high on the car.
- Article claims carbon fiber is about five times lighter than steel; that compares density, and strength or stiffness gains depend on the layup.