

### Hierarchical carbon fiber composites

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Vertically-aligned carbon nanotube (CNT) forest was grown on the surface of carbon fibers (CFs). The mechanical strength of the hierarchical CNT-CFs composite laminates strongly depends on the adhesion between CNT and CFs at the interface. We achieved improvement in the adhesion between the vertically-aligned CNT forest and the CFs. The degree of adhesion was qualitatively assessed using the Scotch-tape test. Epoxy composite was fabricated with the adhesion-improved CNT-CFs specimen for characterizing CNT-CFs sample. The CNT-CFs composite shows 60 times and 1.5 times increase in the electrical conductivity and the fracture toughness over the baseline (CF-only) sample, respectively.