Polymer matrix composites (PMCs) have a number of attractive properties including light weight, high stiffness-to-weight and strength-to-weight ratios, ease of installation on the field, potential lower system-level cost, high overall durability and less susceptibility to environmental deterioration than conventional materials. However, since PMCs contain the polymer matrix, their applications are limited to lower temperatures. In this study, a pyrolysis approach was used to convert the matrix material of phenolic resin into carbon matrix to improve the mechanical and thermal properties of the composites. Composite material consisting of basalt fiber and phenolic resin was pyrolyzed to produce basalt-carbon composites in which the pyrolysis promoted in-situ carbon nanotube growth to form "fuzzy fibers." The carbon phenolic composites was pyrolyzed to produce carbon/carbon composites. Through Raman spectroscopy and scanning electron microscopy, the composition of matrix material was verified. An open-flame oxyacetylene test (ASTM E-285) and three-point bending test (ASTM D790) were used to evaluate the mechanical and thermal properties of the pyrolyzed composites. These test results were compared with the properties of the baseline composites of basalt fiber/phenolic composites and carbon phenolic composites.