Cylindrical carbon–carbon composites have been cemented using a CO2 laser actuated by a raster scanning mirror system in a four-step sequence. Complete and homogenous surface cementation as well as thermal stability of the composites was sought after and achieved. The line of heat created from the laser beam impinged parallel to the axis of the pre-coated cylinder, while suspended from one end and slowly rotated. Four slurry compositions, all containing chloride salts from refractory elements, some combined with silicon, were pre-deposited by air spraying it over each specimen and then laser treated sequentially. Confined heat sublimed the chlorine ions resulting in silicide compounds that reacted with the carbon substrate to form a bonding layer. Microstructure characterization was performed using scanning electron microscopy, energy-dispersive spectroscopy and x-ray diffraction, immediately after the cementation was consolidated and after heat treated under argon. Preliminary oxidation weight loss tests were performed up to 1423 K under argon and air, revealing a 9.8 and 30.6% weight reduction, respectively, after 9 h of exposure. Cemented specimens were then coated with a glass overcoat layer that allowed them to perform moderately better against oxidation achieving up to a 28% weight loss after 20 h at 1273 K in air.