

IDENTIFICATION OF SOOT GENERATED FROM LASER PROCESSING OF TITANIUM ALLOYS

Roy G. Baggerly
Boeing Research & Technology
The Boeing Company

Laser cutting or welding of titanium alloys is normally performed in an inert atmospheric chamber due to the reactivity of titanium with oxygen. Regardless of the care taken during the processes, black soot precipitates on the inside surfaces of a laser welding chamber and the electrostatic precipitator filter collects excessive amounts of dust during laser cutting.

These by-products of the laser manufacturing processes were identified using Fourier transform infra-red analysis (FTIR), energy dispersive spectroscopy (EDS) for chemical analysis, Powder X-ray diffraction for phase analysis and a combined technique of thermo-gravimetric with scanning calorimetry (simultaneous differential thermal Analysis, SDTA). The elemental composition of the soot is predominately composed of Ti, Al, V, O, and C with the amount of the metallic elements varying according to their respective vapor pressures and time at elevated temperatures. Phase analysis using XRD has identified TiO, Rutile TiO₂, and Corundum Al₂O₃ to be the major constituents depending on the process. Minor phases of Aluminum Vanadium Oxide (AlVO₄) and Aluminum Titanium Oxide (Al₂TiO₅) also appear to be present but in much smaller amounts.