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Elemental profiling of laser cladded multilayer coatings by laser induced breakdown spectroscopy and energy dispersive X-ray spectroscopy

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Abstract
Multilayer tungsten carbide wear resistant coatings were analyzed by laser induced breakdown spectroscopy (LIBS) and energy dispersive X-ray (EDX) spectroscopy. Coaxial laser cladding technique was utilized to produce tungsten carbide coating deposited on low alloy steel substrate with additional inconel 625 interlayer. EDX and LIBS techniques were used for elemental profiling of major components (Ni, W, C, Fe, etc.) in the coating. A good correlation between EDX and LIBS data was observed while LIBS provided additional information on light element distribution (carbon). A non-uniform distribution of tungsten carbide grains along coating depth was detected by both LIBS and EDX. In contrast, horizontal elemental profiling showed a uniform tungsten carbide particles distribution. Depth elemental profiling by layer-by-layer LIBS analysis was demonstrated to be an effective method for studying tungsten carbide grains distribution in wear resistant coating without any sample preparation.

Keywords: wear resistant coatings, tungsten carbide, elemental profiling, laser induced breakdown spectroscopy, energy dispersive X-ray spectroscopy