

Femtosecond pulse laser cleaning for the preservation of the Sydney Harbour Bridge

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Abstract

Cleaning with laser light has become a popular technique for the removal of unwanted surface layers. It provides numerous benefits compared to conventional cleaning methods, such as avoiding the use of abrasives and chemicals and eliminating problems of corrosive residues and loss of surface detail. Conventional pulse lasers are the most widely used, and already commercially available, with portable units deployable on-site. However, those lasers rely on thermal mechanisms of ablation, which generate heat and shock waves that can result in undesirable side-effects such as melting, formation of cracks, exfoliation of flakes from the surface, and annealing/softening of thinner sections of the bulk material. Here we explore an alternative heat-free femtosecond laser cleaning technique based on powerful ultrashort pulse lasers. We discuss the capability of the technique, illustrating the significant advantages of femtosecond pulse lasers in removal of old paint and rust without alteration of underlying structure, and discuss the development of a portable femtosecond laser cleaning unit for the maintenance and preservation of large-scale assets around the world using Sydney Harbour Bridge as a real-world field test.

Keywords: Femtosecond pulse laser; femtosecond laser cleaning; heritage conservation; Sydney Harbour Bridge; steel; paint removal.