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Editorial

The Laser—A Junior Member in the Family of Surface Technology Tools

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It takes nature's creatures millions of years of evolution to develop the best-adapted surface for survival. Modern surface technologies such as spraying, cladding, physical, and chemical vapor deposition, and so forth provide a similar service to each technical product, just a little faster. This well-established family of surface technologies has long traditions with the laser as a tool still being a junior member. However, its high degree of flexibility and precision, the constantly improving laser sources and handling technologies, and the decreasing costs per kW are contributing factors to further establish the importance and acceptance of laser-based surface engineering.

Laser surface cladding is based on point-by-point or line-by-line material deposition. The typical lateral line resolution is on the order of 0.1-0.5 mm. This high resolution enables an excellent precision in materials processing, but also implies a comparatively low deposition rate. Therefore, precisely tailored coatings and complex 3-D structures are the domain of the special laser techniques cladding, alloying, and direct metal deposition. Metals, carbides, and composites can be processed for demanding applications in the aerospace and automotive industries as well as in mold and toolmaking. Surface cladding and in particular repair work and rapid design modifications are cost-effective applications for laser surface processes.

The 2006 world market for lasers and laser systems for materials processing was 6.1 billion €.[1] In the field of surface modification technologies, the trend goes to new materials, improved precision and properties, CAD/CAM technology and simulation, as well as the development of practical solutions for system components.

The articles in this issue illustrate the results of current R&D efforts in laser beam cladding. Microstructural analyses of carbide coatings provide an understanding of the relations among material, process parameters, structure, and mechanical properties and therefore helps to select techniques and materials for real-world applications. Computer simulations efficiently support the preparation and optimization of industrial laser cladding processes. New software tools allow not only prediction of the expected manufacturing result, but they also help to define the influence of basic process parameters on optimization criteria such as residual stresses, material seam geometry, and even to enable evaluation of the feasibility of sophisticated cladding applications.

I wish you inspiring reading.

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[1]Optech Consulting, Market Data—Laser Materials Processing, Industrial Laser Quarterly Report, March 2007