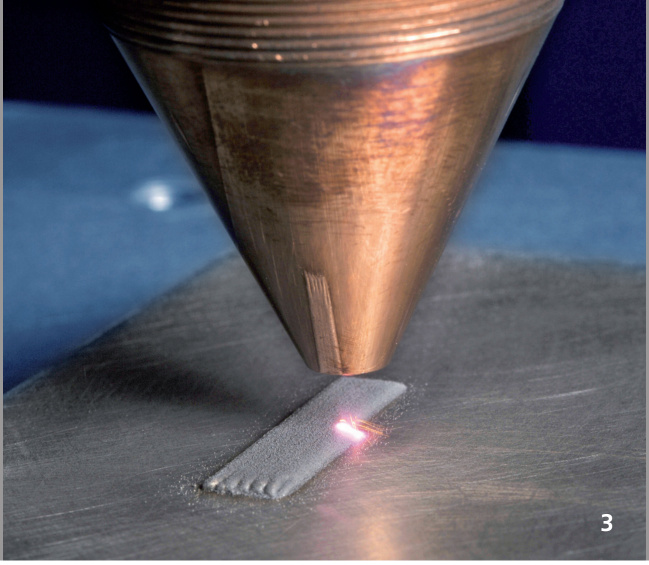

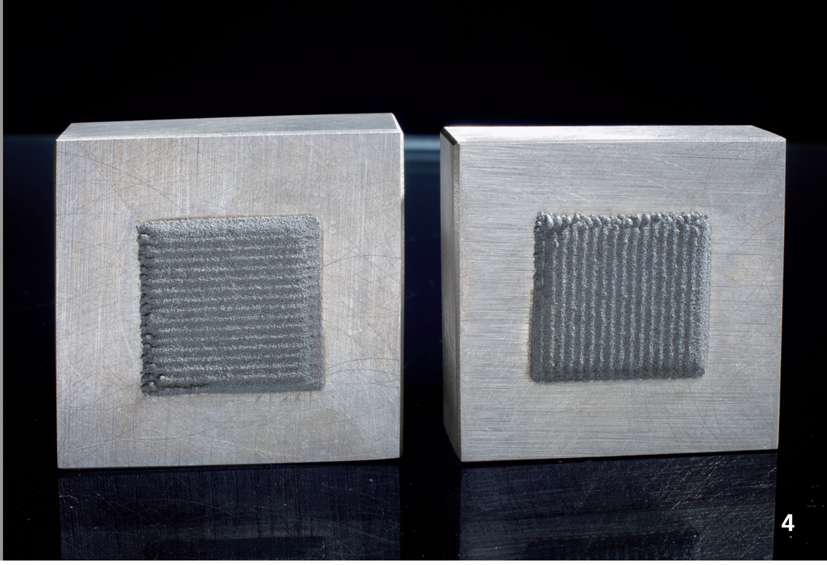

WEAR PROTECTION FOR MAGNESIUM ALLOYS USING LASER CLADDING

Task

Magnesium is used in a wide range of applications, particularly in the automotive and aerospace industries. Demand is constantly growing due to its low density, good damping characteristics and very good machinability compared with aluminum or steel. One drawback of magnesium alloys is, however, their low wear resistance. To address this issue, various layers are deposited on magnesium substrates using laser cladding.

Method

During the laser cladding process, powder fed via a nozzle is melted together with a thin layer of the substrate. A metallurgical bond is created once solidification takes place. The alloy AZ31B is used as a substrate. Layers are manufactured with the aluminum alloy AlSi20, an iron-based alloy (Metco42C) and a composite made of titanium carbide (TiC) and AlSi20. The cladding process is adjusted so that the dilution zone in which brittle intermetallic phases may occur is as small as possible (max. 100 µm).

Result

The laser-clad layers have no cracks or pores. The layer thickness is approx. 1 mm in single-layer configurations. To investigate the wear protection, the various layers were subjected to a pin-on-disc test. The abrasion rate for the substrate AZ31B is $1.23*10^{-03}$ mm³/Nm. With an AlSi20 layer the abrasion rate can be reduced by a factor of 2.6 to $4.76*10^{-04}$ mm³/Nm, with an AlSi20+TiC layer by a factor 2.9 to $4.16*10^{-4}$ mm³/Nm. The largest effect is obtained with an iron-based layer with $1.69*10^{-04}$ mm³/Nm (factor 7.3), which cannot be applied directly on magnesium due to its high melting point, but requires an interlayer made of AlSi20.

Applications

Magnesium alloys are used as materials for gear and engine housings. Here the laser cladding process either can be used on wear-affected areas preventively or retrospectively as a repair process.

Contacts

Dipl.-Ing. Gesa Rolink
Phone +49 241 8906-365
gesa.rolink@ilt.fraunhofer.de

Dr. Andreas Weisheit
Phone +49 241 8906-403
andreas.weisheit@ilt.fraunhofer.de

3 Laser cladding on AZ31B.

4 AlSi20 coating on AZ31B.