

## **A big job for a small head**

Gearbox repair specialists put iClad to the test

**In the race against time, the specialists at the Dutch company Stork Gears & Services BV, Rotterdam, have made a name for themselves all over the world in sectors like the shipbuilding, petrochemical, wind power and steel industries. In all of these branches, the maximum uptime of efficient gearboxes and associated drive systems is of crucial importance. As quickly as possible, the experts at Stork repair damaged or failed gearbox-related components, rebuilding them or replacing them with new parts. In emergencies, Stork's engineers are even on the spot within a day. In this line of work, laser cladding is used as a tried-and-tested technology to prevent wear-out and unwanted material changes. The team led by Jelmer Brugman, head of Stork's laser cladding department, successfully apply this technique on more than 20 gear repair or modification jobs per month on average. However, in about 10 percent of the cases, inaccessible internal surfaces could not be treated with conventional laser processing heads. Until about a year ago, there was no alternative but to replace the damaged parts with new ones. But since then, using iClad, a laser processing head for the treatment of internal contours from a diameter of 26 mm and to a depth of 600 mm, the Dutch company has opened up new possibilities for the repair of these critical components. Compared with the previously unavoidable effort involved in such cases for the production of a new part from scratch, the iClad technology means time-saving of well over 90 percent.**

Whether on water, on land or in the air, numerous technically demanding branches of industry rely on the leading competence of the manufacturer-

independent experts at Stork Gears & Services for the maintenance, rebuilding and repair of their gears. With a staff of 180, the Dutch specialists guarantee the fastest possible restoration of damaged gearbox-related components. Stork's technicians are at work around the clock on all continents repairing damaged drive systems at short notice and thus minimising breakdown-related costs. In the maritime industry, gearboxes and gearwheels have to withstand even the hardest of conditions. Whether for gravel pumps or ship propellers, deck cranes, winches or generators, the drive systems of dredger, container and offshore supply vessels are under plenty of pressure. In the worst case, broken or damaged gearwheels due to abrasion, erosion or corrosion may lead to complete failure of the aggregates. In power stations or wind power plants the efficiency of the turbines also depends primarily on the maximum uptime of highly stressed gears. Damage to gearwheels, bearings and connections due to wear and tear compromise operational reliability through unplanned downtimes. For the preventative maintenance, modification and repair of such heavily stressed drive systems, Stork Gears & Services rely on laser cladding.

### **Maximum precision**

A 2-kilowatt diode laser applies highly localised heat, which makes this technology particularly suitable for the processing of all new or damaged components where maximum precision of coating with minimal distortion is called for. The laser beam melts the component's surface and the powder which is jet-sprayed onto it, and joins them metallurgically into a homogeneous coating with low dilution. For Jelmer Brugman, this is the leading technology for the repair or refitting of critical, highly stressed components through the application of a new coating designed to meet the specific demands. However, so far the standard processing heads available for this proven technique had limited the application of laser

cladding to the treatment of freely accessible surfaces and structures, or to internal contours with an access aperture of at least 100 mm diameter.

### **Smallest diameter**

For one year now, Stork Gears & Services have been exploring a new approach to this problem. As one of the first industrial-scale users, Stork has been using the **iClad** internal laser processing head, developed by the company Pallas GmbH, headquartered in Wuerselen near Aachen, Germany, in collaboration with the Aachen Fraunhofer Institute for Laser Technology (ILT). This special processing head can be used for internal contours from a diameter of 26 mm and to a depth of 600 mm and covers the complete range of internal surface treatment needs: hardening, alloying, and coating. All the necessary assemblies for beam guidance and beam forming as well as for process media feed are integrated into a compact casing. **iClad** laser processing heads consist of three modules: powder feed nozzle, main body and fibre plug. An active water cooling system protects the optical components against overheating. An internal lens protection prevents contamination or destruction through deposits of powder particles. In addition, the optical path is constantly flushed with shielding gas. The plugs for fibre cables and feed lines for the process media are located at the rear end of the head.

### **Shortest time**

In 2009, Stork Gears & Services decided to use the **iClad** prototype as a special model with integrated collimation. This was a fixed 42-head for the internal coating of 50 mm bores to a working depth of 500 mm. One year later, Jelmer Brugman looks back in satisfaction on about 20 deployments of the slender processing head. The new technology has proven itself, both for repairs of gearwheels, gearboxes and clutches and for the production of replacements. Since most of these jobs were for single parts and not serial production, **iClad** was faced with a whole range of

formidable challenges. For example, an old, large gearwheel that opened and closed a bridge mechanically had to be repaired in a matter of days. The bore, just 18.5 cm wide and 40 cm deep, was damaged. "Without **iClad**, we would have had to develop and produce the whole gearwheel, with a diameter of 2.20 meters, completely from scratch. But the delivery time for the required materials alone would have taken at least six months," says Jelmer Brugman, explaining the difficulty of the task. An alternative repair option was not available. The standard processing head used by Stork Gears & Services for laser cladding was unsuitable for this particular case. But the deployment of **iClad** allowed a fast, high-quality solution. First, Stork pre-treated the damaged bore mechanically. Then, the bore was coated via laser cladding over a length of 40 cm and dressed to the original size. Within three days, the gearbox was completely restored. A processing time that – compared with the production of a replacement even under the most favourable conditions – signifies a 96 percent saving on time. The reduction of costs that goes along with this is a welcome, yet secondary factor for the customers. "Time is all that counts for them!" says Jelmer Brugman. The new possibility for internal contour treatment has also been used successfully in large-scale jobs for the wind power industry.

### **Impressive performance**

"By rendering such small internal spaces accessible, **iClad** has significantly enlarged our scope of service," says the Head of the Laser Cladding Department, summarising his experience of the innovative processing head. And he adds, "A first milestone in the collaboration with Pallas was the adaptation of the head to our diode laser. Since then, **iClad** functions well and works perfectly!" He still sees room for improvement in the long-term durability of individual components that were installed in his prototype. Stephan Kalawrytinios, Managing Director of Pallas GmbH, has two proposals for a solution to this problem. Stork

Gears & Services can either avail themselves of a fast replacement service for individual components, or, alternatively, they can go for a complete adaptation of the prototype head to the latest developments, i.e. a rebuild to an optimal configuration of the critical components. Which alternative is better for the tough day-to-day conditions under which the Dutch specialists for time-critical gear repair work will become apparent through further continuous operation. The first year of use for the new processing head at Stork Gears & Services is an impressive confirmation of **iClad**'s range of performance for process-related optimisation and repair. Previously inaccessible surfaces and structures of wear-prone components from wide-ranging industrial fields of application have now been successfully treated with specific coating to meet the challenges of their wear-intensive daily lives.

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