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# FLEXIBLE PROTOTYPE MACHINE FOR THE INDUCTIVELY ASSISTED LASER ROLL PLATING

## THE TASK

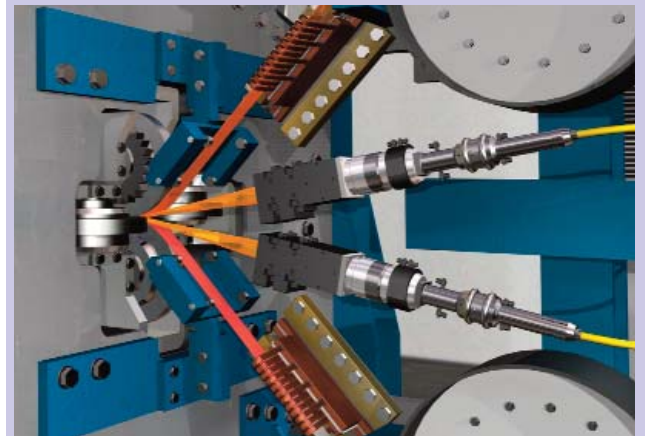
The current development trends in the automotive industry are electromobility and lightweight construction. These trends address issues such as the drastic increase of costs of important metals. They also lead to an increased demand for semi-finished products of metal composites. An example is the need for Al-Cu parts for the cost effective manufacturing of lithium ion batteries.

In collaboration with industrial partners, Fraunhofer IWS engineers developed a special inductively assisted laser roll plating process and build a laboratory machine to join narrow strips of Al and Cu. As opposed to the conventional hot roll plating this new process inductively preheats the precut strips to the required temperature for joining them in a roll tool whereas the inner surfaces are heated by laser. The laboratory machine was originally limited to a fixed strip geometry and limited band length. To further develop the inductively assisted laser roll plating as an industrial process it was necessary to expand the machine's capabilities.

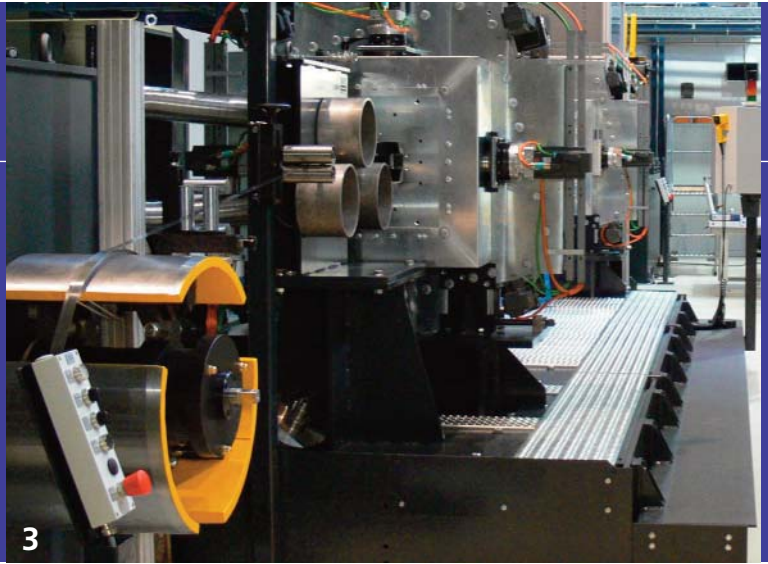
## OUR SOLUTION

Fraunhofer IWS engineers designed a unique inductively assisted laser roll plating machine with the flexibility to process varying strip geometries. An industrial partner built and installed the machine in a very short time. The machine was completed with the induction generators, the laser and a specialized beam shaping optics. The first tests were performed.

*Arrangement: inductive and laser heating of the bands*



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## RESULTS

The core of the machine is a rolling frame, which works on the principle of the so-called "flexible Turks head". The method uses 4 staggered rolls to provide the necessary roll gap and can change the gap geometry without having to change the rolls. Immediately in front of the roll gap is the heating zone. Two disk lasers are used to provide the heating energy through linear foci on the inner side of the bands.

Two HF generators with 50 and 100 kW power inductively preheat the bands. The maximal width is 150 mm for bands of up to 4 mm thick. The achievable roll plating width depends on the laser power. The machine also includes mechanisms for handling the band coils, which can carry up to 1 ton. Additional elements are included for alignment and brushing. The machine also houses a second Turk head roll frame, which is used for calibration and final shaping of the plated strips. Both roll frames are mounted to the same machine stage, which also holds the movable panel of the NC machine controller. The system is completed with a special protective gas enclosure for those regions where the band is warm and at the roll gap. The plated band is gas cooled. Several cameras and pyrometers are used for process observation. The new machine has an overall length of 18.5 m.

The machine design is such that it is possible to plate band-to-band but also band-to-profile. The total physical deforming during laser roll plating is relatively small. Thus it will be also possible in future to join materials in overlapping configuration, which is useful to optimize components for reduced material use.

In addition to the mentioned material combinations the technology is also suitable to roll plate different steels as well as steel and aluminum, titanium or copper alloys.

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- 1 *Machine schematics*
- 3 *Roll plating machine at the IWS*

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