Metal deposition drive

It is every apprentice’s dream to have a ‘putting on’ tool. Using Trumpf’s Direct Metal Deposition technology, TWI is making dream reality.

**Direct Metal Deposition (DMD)** was originally developed to offer repair/modification for mould tools. Using a powerful CO₂ laser, a pool of molten material is formed on the damaged area of a component, into which is deposited metal powder. Spotting its potential, the TWI Technology Centre in South Yorkshire has installed a Trumpf DMD505 (pictured) and is investigating rapid prototyping and manufacture of original parts.

Dr Robert Scudamore, section manager at TWI’s Yorkshire Lasers and Sheet Processes Group has been actively involved with the installation of the DMD505 and says: “We have done some work on deposition in the past, but it hasn’t been an area that we have actively pursued up until now.” This refocusing of attention came about two years ago when TWI started work on a core research programme to investigate the deposition of nickel-based super alloys. This resulted in a major effort on TWI’s part to advance the technology, including the design and build of a nozzle for the project.

The potential of the process then became evident. “We now see laser deposition as being a big area for us. Given our long pedigree in using and developing laser processes and the materials analysis expertise we have built up over the years analysing welded materials, we are able to grasp the opportunity, develop the process and pass on our knowledge to our member companies.”

While mould tool repair remains a central function of the deposition process, TWI is particularly interested in developing DMD for ‘additive manufacture’. Such manufacturing techniques are of particular interest to the aerospace sector where components are of high value and machining processes waste a high proportion of the original material. Additive manufacture builds the component rather than machining it. “A future application of this technology will be the production of projections onto components with high material cost. Savings are made because far less material is needed if the projection is not to be machined. The projection can be added later using DMD.”

The Trumpf DMD505 laser deposition system is installed at its current facility, although scheduled for relocation in a purpose-built unit centred on a cluster of research, technology and manufacturing companies at the end of 2004. It has a ‘processing’ envelope of 1.1 m by 2 m by 0.75 m and can work on components weighing up to 7 tonnes. “Trumpf is one of the few companies in the world capable of producing a machine of this type, thanks to the scale of its resources,” says Dr Scudamore. “Unlike many of the niche manufacturers of DMD equipment, the Trumpf machine has wide appeal to many different industry sectors.”

Operating the DMD505 is relatively simple as the deposition is controlled through a CNC menu system. The operator programs the CNC system to supply the correct laser power, processing speed and powder flow rate. Precise 3D deposition is achieved by using a specially designed coaxial nozzle mounted on a 5-axis gantry. A specialised Trumpf feedback and control system monitors the deposition dimensions using three infrared cameras. The output from these cameras is fed to a control computer that regulates the processing parameters if the dimensions of the deposit have moved out of specification.

As with rapid prototyping, DMD can be used for reverse engineering, parts can be scanned, and a toolpath created using 3D CAD software. The potential for the process is huge as Dr Scudamore concludes: “If it can be welded, it can be deposited.”

**TWI pedigree**

Formed in 1946 as a spin-off from Cambridge University, TWI is a membership-based research organisation employing over 200 graduates researching new processes and offering problem-solving capabilities to its members. With a long history of using and developing laser technology, having invented the axial flow laser, it is well placed to push the technology barriers further. With funding from the various regeneration grants and the South Yorkshire Regional Development Agency – Yorkshire Forward – it is now actively involved in the Direct Metal Deposition field at its newly formed subsidiary TWI Technology Centre (Yorkshire) Ltd.