



PRESENTS NEW TECHNOLOGIES

Gas-dynamic metal deposition

Part 3: Restoration of defected or damaged parts

Basic features of gas-dynamic deposition technology

The equipment for gas-dynamic metal deposition (GDMD) is designed to coat a variety of surfaces with aluminium, zinc, copper and other metals. The coatings can be applied in a wide range of assembly, repair and restoration works in various areas of industry. The equipment is made as a portable rack (fig. 1) where a manual spray gun, powder feeders, air preparation elements and electric controllers are mounted. Compressed air, electric power and metal powders are required for the equipment to work.



Figure 1. Dymet Equipment

The equipment is based on a gas-dynamic spraying method developed in 1980s. This method utilises a supersonic air jet to carry the metal particles to the surface of a substrate. Due to their high velocity, the particles are deformed and adhere to the substrate. Laboratory tests of the coatings of various metals determined the following properties:

- high adhesion (30-80 MPa);
- high cohesion (30-80 MPa);
- low porosity (1-5 %);

Gas-dynamic metal deposition is a new method, and practically unknown in the Australian industry.

The experience of its practical application shows that this technology is highly effective for elimination of defects of various details and parts where high hardness or wear resistance of the coatings is not required. The uniqueness and high efficiency of this technology is determined by the following facts:

- Low temperature spraying does not lead to deformations, mechanical and thermal stresses, and structural changes of metal parts
- Localised spraying jet does not affect adjacent areas
- Restoration of thin wall parts is feasible where the other methods cannot be used

Clearing of casting defects

One of the most effective applications of GDMD technology is elimination of defects and damages of light metal castings, in particular, aluminium engine blocks and cylinder heads, alloy wheels, inlet and outlet manifolds and other automotive components.

Typical defects of castings are microcracks, flaws, cavities, bowls, through porosity. These defects may not affect on mechanical properties and reliability of the products, but they definitely influence their appearance and, therefore, their commercial value.

The GDMD equipment can be used for all restoration and repair works with aluminium castings, except the case when a defective place is not geometrically accessible by the spray gun of the equipment. In comparison with argon-arc welding the use of GDMD equipment significantly facilitates the process of repair by reducing repair time, excluding the operation of preheating of details and providing a guaranteed hermetic sealing of the defect area.



Figure 2

The operation sequence of filling up an incorrectly drilled hole in a thin-walled aluminium casing is shown in fig. 2:

- a hole
- inserting a plug
- spraying a powder
- milling the deposited metal

Thus, the appearance, size and impermeability of a product are completely restored.

Many casting defects revealed during machining of an aluminium part can be similarly eliminated. Fig. 3 presents a photo of the cast case of automobile transmission. The case had a crack on a lateral surface. The defect was fixed within 20 seconds. The volume of the sprayed coating was 0,5-0,7 cm³.

Fig. 4 shows a part of the frame of a complex device. A wall section of the frame was restored using GDMD method. During the spraying process the surface temperature of the frame did not exceed 50°C, which completely excluded a probability of any warpage or distortion of this precision part.

A similar example of restoration of the geometrical size of an openwork aluminium arm is presented in fig. 5. Actually, any other methods, except gas-dynamic spraying, do not allow such work to be performed.



Figure 3.

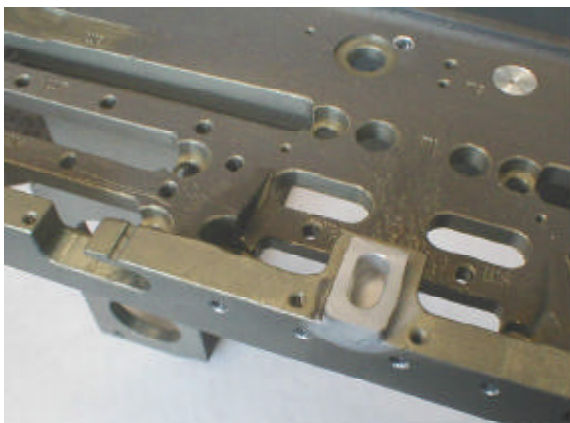
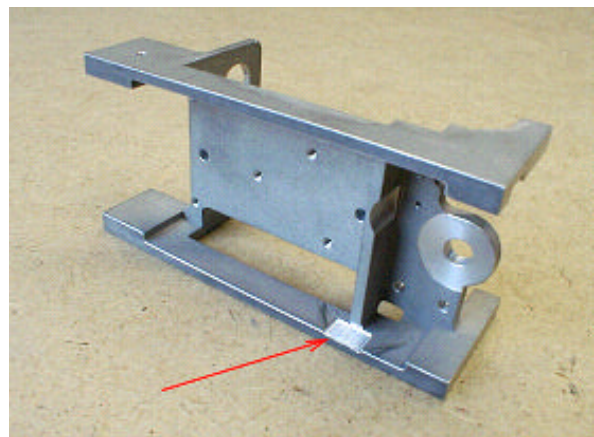


Figure 4

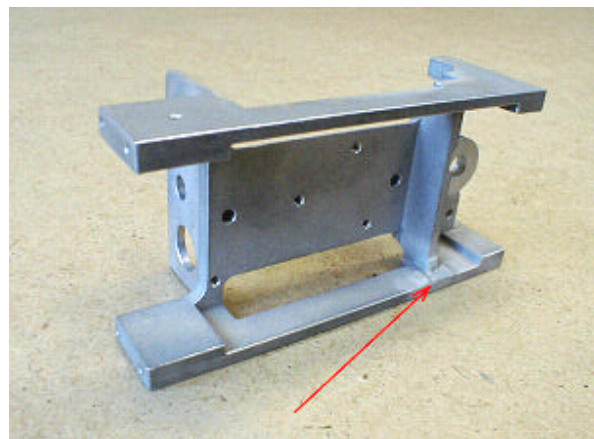


Figure 5

Restoration of parts after machining

More difficult situations arise when castings are exposed to complex and time-consuming machining. Some defects can be found when processing is complete.

Fig. 6 demonstrates a more complex aluminium part – the case of an aviation gyroscope. After the casting was processed on the CNC machine several microcracks and flaws were revealed which prevented the part from further use and required to reject the product. The use of argon-arc welding for elimination of the defects was not allowed due to high temperature and possible warpage of the part. The application of DYMET equipments allowed to completely eliminate the revealed defects and provide impermeability of the product. Special bench tests of the coatings showed their tightness, shock resistance, vibrostability and temperature resistance under a wide range of parameter variations.



Figure 6

Restoration of cast iron parts

In some cases, when hardness or wear resistance of the coatings is not required, the method can be used for repair of defects of cast iron components. Thus, fig. 7 shows defected cast iron part (left photo).



Figure 7

The defect was revealed after turning process. The aluminium coating was applied on a defective area (right photo). After additional mechanical processing the part can be used in the further manufacture.

On-floor modification of parts

In the process of development of a new part it is sometimes required to modify the part on floor. Gas-dynamic deposition is a good tool to build-up an additional volume of metal on the surface. An example of such application is shown in the fig. 8

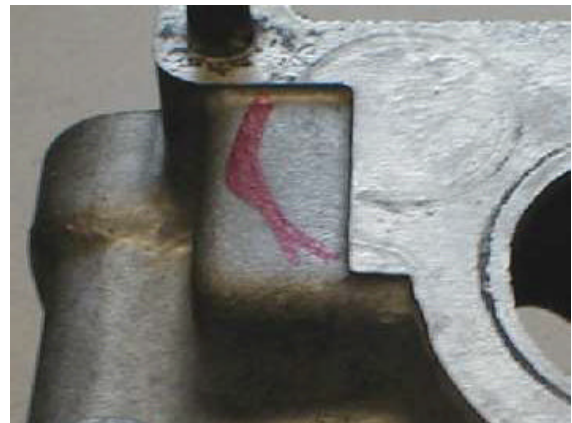


Figure 8

Test results

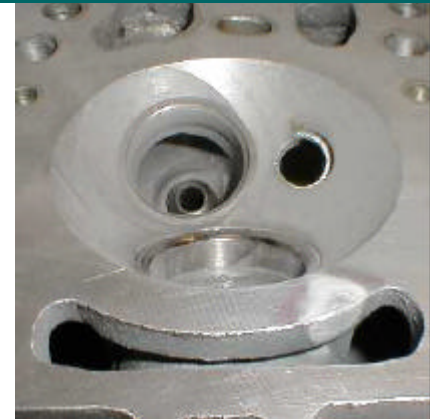
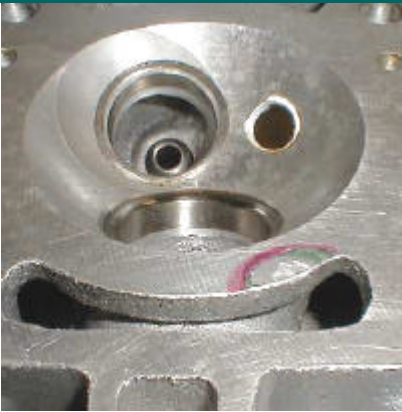
Laboratory tests and operational trials of the coatings and parts of various machines and the mechanical components, repaired with DYMET equipment, approved their high quality. Technical and economic estimations show that DYMET equipment provides industry and repair services with a new cost-effective tool which has not been in practice of repair earlier.

Other examples of GDMD applications

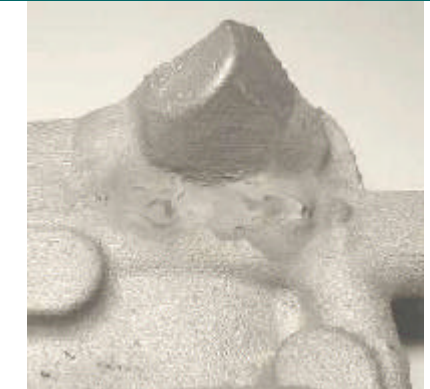
Clearing of cylinders defects



Fixing defects of head of block of cylinders



Filling up flaws in an aluminium body



InnovEco
Australia
ABN 60 162 832 634

Postal Address:
PO Box 486
Enfield Plaza
SA 5085

Tel:
0423 154 667
0411 099 404
Tel/Fax:
+61 8 8340 3090

URL:
www.innoveco.com.au
E-mail:
contact@innoveco.com.au
innoveco_au@hotmail.com