

## **Conventional Machining VS Non-Conventional Machining**

Conventional machining usually involves changing the shape of a workpiece using an implement made of a harder material. Using conventional methods to machine hard metals and alloys means increased demand of time and energy and therefore increases in costs; in some cases conventional machining may not be feasible. Conventional machining also costs in terms of tool wear and in loss of quality in the product owing to induced residual stresses during manufacture. With ever increasing demand for manufactured goods of hard alloys and metals, such as Inconel 718 or titanium, more interest has gravitated to non-conventional machining methods.

Conventional machining can be defined as a process using mechanical (motion) energy. Non-conventional machining utilises other forms of energy. The three main forms of energy used in non-conventional machining processes are as follows :

- Thermal energy
- Chemical energy
- Electrical energy

One example of machining using thermal energy is laser. Thermal methods have many advantages over conventional machining, but there are a few of disadvantages.

- Inconel 718, titanium and other hard metals and alloys have a very high melting point. Using thermal methods will require high energy input for these materials.
- Concentrating heat onto any material greatly affects its microstructure and will normally cause cracking, which may not be desirable.
- Safety requirements for thermal methods, especially laser, are demanding in terms of time and cost.
- Machining large areas or many surfaces at the same time using thermal methods is not normally possible.

The methods using electrical energy are electrodischarge machining (EDM) and anodic machining (AM), which are similar in practice. EDM, often referred to as spark erosion, uses pulsed voltage to remove material from a workpiece and a non-conductive medium

to clear the debris. Because the medium is electrically inert the tool is a direct reverse of the workpiece and no complicated tool design criteria are required. But the shock of spark erosion can affect the microstructure on the surface of the workpiece. Also, EDM has a lower material removal rate than AM.

The chemicals used in AM are non-toxic and the energy required is less than other non-conventional machining processes. It has no effect on the microstructure of the workpiece. The electrolyte can even be common sea water, enabling AM to be used in a sub-sea capacity. The hardness and thermal resistivity of the workpiece material do not matter therefore hard metals and alloys can be machined using tools made from softer materials. The only disadvantage is that tool design is a little more complex than that of EDM, but software is being developed to make this easier. The controllability, environmental versatility, speed, safety and absence of change in workpiece microstructure make AM a competitive manufacturing process.