



AGS-TECH Inc.

Phone: +1-505-550-6501 and +1-505-565-5102 Fax: +1-505-814-5778

Email: sales@agstech.net

Web: <http://www.agstech.net>

INTRODUCTION:

Manufacturing processes can be broadly divided into two groups and they are primary manufacturing processes and secondary manufacturing processes. The former ones provide basic shape and size to the material as per designer's requirement. Casting, forming, powder metallurgy are such processes to name a few. Secondary manufacturing processes provide the final shape and size with tighter control on dimension, surface characteristics etc. Material removal processes are mainly the secondary manufacturing processes.

Material removal processes once again can be divided into mainly two groups and they are "Conventional Machining Processes" and "Non-Traditional Manufacturing Processes".

Examples of conventional machining processes are turning, boring, milling, shaping, broaching, slotting, grinding etc. Similarly, Abrasive Jet Machining (AJM), Ultrasonic Machining (USM), Water Jet and Abrasive Water Jet Machining (WJM and AWJM), Electro-discharge Machining (EDM) are some of the Non Traditional Machining (NTM) Processes.

Conventional Machining VS. Non-Conventional Machining:

Conventional machining usually involves changing the shape of a work piece using an implement made of a harder material. Using conventional methods to machine hardmetals 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 utilizes other forms of energy.

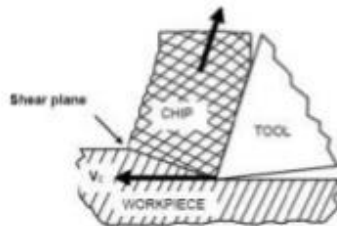
The three main forms of energy used in non-conventional machining processes are as follows:

- Thermal energy
- Chemical energy
- Electrical energy

Comparison

Conventional Manufacturing Processes

1. Generally macroscopic chip formation by shear deformation.



2. There may be a physical tool present. for example a cutting tool in a Lathe Machine,
3. Cutting tool is harder than work piece at room temperature as well as under machining conditions
4. Material removal takes place due to application of cutting forces – energy domain can be classified as mechanical

Non-Conventional Manufacturing Processes

1. Material removal may occur with chip formation or even no chip formation may take place. For example in AJM, chips are of microscopic size and in case of Electrochemical machining material removal occurs due to electrochemical dissolution at atomic level
2. There may not be a physical tool present. For example in laser jet machining, machining is carried out by laser beam. However in Electrochemical Machining there is a physical tool that is very much required for machining.
3. There may not be a physical tool present. For example in laser jet machining, machining is carried out by laser beam. However in Electrochemical Machining there is a physical tool that is very much required for machining.
4. Mostly NTM processes do not necessarily use mechanical energy to provide material removal. They use different energy domains to provide machining. For example, in USM,

<ol style="list-style-type: none"> 5. Conventional machining involves the direct contact of tool and work –piece 6. Lower accuracy and surface finish. 7. Suitable for every type of material economically 8. Tool life is less due to high surface contact and wear. 9. Higher waste of material due to high wear. 10. Noisy operation mostly cause sound pollutions 11. Lower capital cost 12. Easy set-up of equipment. 13. Skilled or un-skilled operator may required 14. Generally they are manual to operate. 15. They cannot be used to produce prototype parts very efficiently and economically. 	<p>AJM, WJM mechanical energy is used to machine material, whereas in ECM electrochemical dissolution constitutes material removal.</p> <ol style="list-style-type: none"> 5. Whereas unconventional machining does not require the direct contact of tool and work piece. 6. Higher accuracy and surface finish. 7. Not Suitable for every type of material economically 8. Tool life is more 9. Lower waste of material due to low or no wear. 10. Quieter operation mostly no sound pollutions are produced. 11. Higher capital cost 12. Complex set-up equipment. 13. Skilled operator required. 14. Generally they are fully automated process. 15. Can be used to produce prototype parts very efficiently And economically.
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