



# U3

## *Unconventional Machining Processes*

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Principles of working and applications of Mechanical Energy Process-Ultrasonic Machining, water and Abrasive jets, Electrochemical Machining process -Electrochemical Machining, Electrochemical Deburring and Grinding, Thermal Energy process -Electric Discharge process, Electron Beam Machining, Laser beam Machining.

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### INTRODUCTION

In conventional machining processes the ability of the cutting tool is utilised to stress the material beyond the yield point to start the material removal process. This requires that the cutting tool material be harder than the workpiece material. The advent of harder materials for aerospace applications have made the removal process by conventional methods very difficult as well as time consuming since the material removal rate reduces with an increase in hardness of the work material. Hence *machining processes which utilise other methods such as electro-chemical processes are termed as **Unconventional or Non-traditional machining methods.***

The main **reasons** for using non-traditional processes are :

- (i) High strength alloys.
- (ii) Complex surfaces.
- (iii) High accuracies and surface finish.

### CLASSIFICATION OF UNCONVENTIONAL MACHINING METHODS

The unconventional methods can be broadly *classified* on the basis of the following criteria :

#### 1. **Type of energy :**

- (i) Chemical
- (ii) Electro-chemical
- (iii) Mechanical
- (iv) Electrothermal.

#### 2. **Mechanism of metal removal :**

- (i) Shear
- (ii) Erosion
- (iii) Chemical ablation
- (iv) Ionic dissolution
- (v) Spark erosion
- (vi) Vaporisation etc.

## UNCONVENTIONAL MACHINING PROCESSES

### 3. Media for energy transfer :

- (i) Physical contact
- (ii) High velocity particles
- (iii) Reactive atmosphere
- (iv) Electrolyte
- (v) Hot gases
- (vi) Electrons
- (vii) Radiation etc.

### 4. Source of energy :

- (i) Hydraulic or pneumatic pressure
- (ii) Mechanical pressure
- (iii) Corrosive agent
- (iv) High current
- (v) High voltage
- (vi) Ionized gas etc.

### ● Common Unconventional Machining Methods :

1. Electrical Discharge Machining (EDM)
2. Electro-Chemical Machining (ECM)
3. Electro-Chemical Grinding (ECG)
4. Ultrasonic Machining (USM)
5. Electron Beam Machining (EBM)
6. Laser Beam Machining (LBM)
7. Plasma Arc Machining (PAM)
8. Abrasive Jet Machining (AJM)
9. Chemical Machining (CHM).

## SELECTION OF PROCESS

*For selecting a particular process the following common parameters should be taken into consideration :*

1. Shape and size required to be produced.
2. Physical properties of the work material.
3. Process economy.
4. Process capabilities such as expected tolerance, surface finish, rate of metal removal, power requirement etc.
5. Type of operation required (e.g., cutting, hole making etc.)