Production Technology Metal cutting Process

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Abstract

The purpose of metal cutting process is to provide cooling and reduce the friction between tool and work piece at the shearing zone. In dry cutting , the work piece machined under dry conditions. The air surrounding the work piece acts as the cooling agent. Metalworking is the process of working with metals to create individual parts, assemblies, or large-scale structures. The term covers a wide range of work from large ships and bridges to precise engine parts and delicate jewelry. It therefore includes a correspondingly wide range of skills, processes, and tools. Metal working is a science, art, hobby, industry and trade. Its historical roots span cultures, civilizations, and millennia. Metalworking has evolved from the discovery of smelting various ores, producing malleable and ductile metal useful for tools and adornments. Modern metalworking processes, though diverse and specialized, can be categorized as forming, cutting, or joining processes. Today's machine shop includes a number of machine tools capable of creating a precise, useful workpiece.

Introduction

Metal cutting is the process of producing a job by removing a layer of unwanted material from a given workpiece. Fig. shows the schematics of a typical metal cutting process in which a wedge shaped, sharp edged tool is set to a certain depth of cut and moves relative to the workpiece.Under the action of force, pressure is exerted on the workpiece metal causing its compression near the tip of the tool. The metal undergoes shear type deformation and a piece or layer of metal gets repeated in the form of a chip.If the tool is continued to move relative to workpiece, there is continuous shearing of the metal ahead of the tool. The shear occurs along a plane called the shear plane.All machining processes involve the formation of chips; this occurs by deforming the work material on the surface of job with the help of a cutting tool. Depending upon the tool geometry, cutting conditions and work material, chips are produced in different shapes and sizes. The type of chip formed provides information about the deformation suffered by the work material and the surface quality produced during cutting.

Types of Chips:

Continuous chips: While machining ductile materials, large plastic deformation of the work material occurs ahead of the cutting edge of the tool. The metal of the workpiece is compressed and slides over the tool face in the form of a long continuous chip.

Discontinuous (segmented) chips: A discontinuous chip is a segmented chip produced in the form of small pieces. The discontinuous chips are produced when cutting brittle materials like cast iron, bronze and brass. The working on ductile materials under poor cutting condition may also sometimes lead to the formation of discontinuous chips.

Continuous chips with built-up-edge: The term built-up-edge refers to the small metal particles that stick to the cutting tool and the machined surfaces as result of high temperature, high pressure and high frictional resistance

during machining. The building up and breaking down of the built-up-edge is periodic; its size first increases, then decreases and again increases-the cycle gets repeated rapidly.

Today there are several types of cutting tools for different applications and purposes; largely, they form two classifications –

1. Single-point – e.g. knives, scissors
2. Multi-point – e.g. drilling, grinding, milling etc.

The manufacture of cutting tools falls into three major uses:

1. Leather cutting
2. Metal cutting
3. Glass cutting

These tools cater to different needs of cutting and hence they have specific geometry to provide 'clearance angles' for neater and precise cutting. The characteristics required to produce good quality tools and parts are:

- **Hardness** – which includes the hardness and strength of the tool at elevated temperatures, which is referred to as 'hot hardness'
- **Toughness** – tools should not chip or fracture, which is a possible occurrence in interrupted cutting operations
- **Wear-resistance** – cutting tools have to be conform to accepted 'attainment of life' before they are replaced

Metal Cutting Tools

As the name suggests, cutting tools to cut metal have to be very durable and strong. Domestic usage of metal cutting tools involve those that are hand operable such as chisels, hacksaws, shears and snips. In industrial processes that involve heavy duty metal cutting, tools such as cutters, drills, reamers etc. are used.

Metal cutting processes

The various forms and processes of metal cutting involve:

1. **Turning** – cuts and shapes top layers of metal to pre-determined sizes.
2. **Drilling** – a combination of rotation and force cuts holes of required sizes in metals.
3. **Grinding** – uses an abrasive wheel that rotates with force against the metal creating a smooth and high quality surface.
4. **Welding** – uses the application of high-temperature and focused heat to cut metal along certain lines or folds.
5. **Oxy-acetylene or flame** – heats the metal to melting point where a directed stream of oxygen makes the metal melt.
6. **Laser** – an advanced technology which involves the use of an intensely concentrated light-beam that can be 'beamed' to tiny points of high temperature under controlled conditions to cut metal into required shapes or objects.
7. **Plasma** – a very contemporary technique that uses a plasma torch to pump oxygen or any other inert gas at high speed through a nozzle which is then electrified with an electrical arc creating plasma that is hot to not only cut or slice the metal but also remove any molten metal thereby giving a clean cut.

Conclusion:-

- The efficiency of laser metal cutting, plasma metal cutting and punching machine is more than handy metal cutting tools.
- Giving the shape to the metal, then turning, drilling, grinding processes are used.
- We use grinding process for maintaining the softness of metal

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