Description

Image

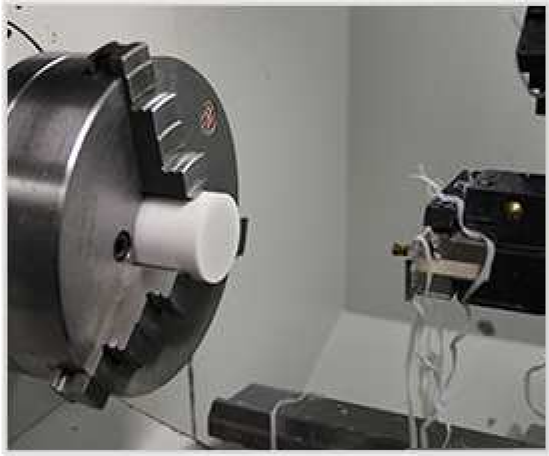
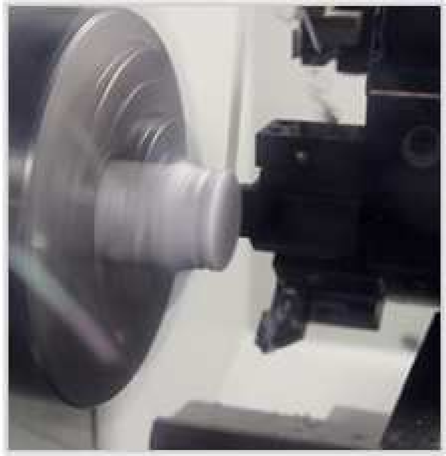


Image caption

(1) Turning machine preparation © Granta Design at TU Delft University
(2) Turning machine in action © Granta Design at TU Delft University
(3) Example of a turned product © Granta Design at TU Delft University

The process

TURNING generates external surfaces of revolution by removing material from a rotating workpiece with a single-tipped cutting tool. The workpiece is gripped in a chuck mounted in a lathe that provides the rotary motion. BORING is this same action applied to internal surfaces of revolution. It is the most commonly used process for enlarging or finishing holes or other circular contours. Although most boring operations are done on simple, straight-through holes (ranging upward in diameter from about 6 mm), tooling can be designed for boring blind holes, holes with bottle-shaped configurations and bores with steps, undercuts, and counterbores. Boring is used after drilling to increase dimensional accuracy and finish, and for finishing holes too large to be produced economically by drilling, such as large cored holes in castings or large pierced holes in forgings. PARTING is the separation of a turned object from the stock from which it was made by turning the section down to zero.

Process schematic

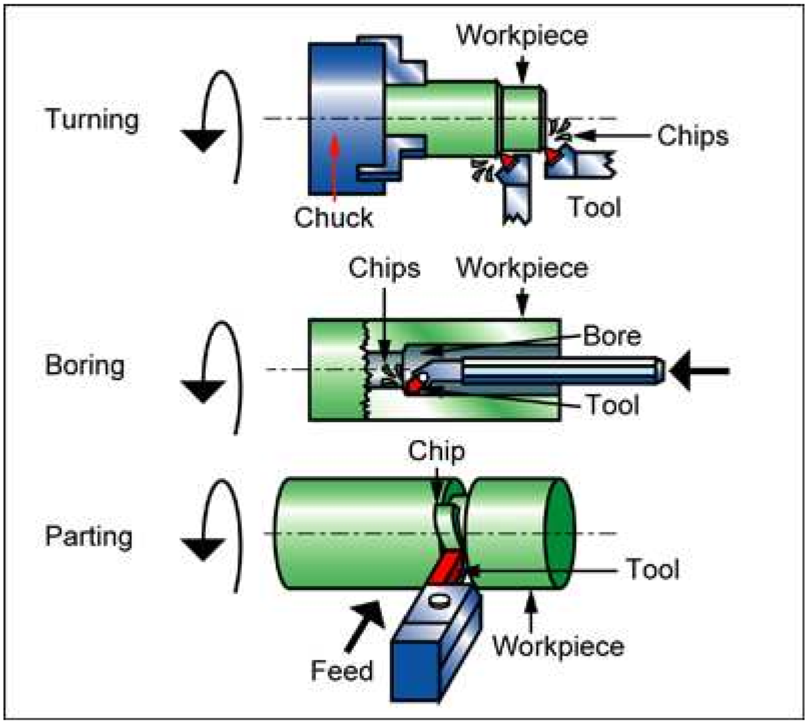

Figure caption

Turning, boring and parting operations performed on a lathe.

Material compatibility

Metals - ferrous	✓
Metals - non-ferrous	✓
Natural materials	✓
Polymers - thermoplastics	✓
Polymers - thermosets	✓

Shape

Circular prismatic	✓
Solid 3-D	✓
Hollow 3-D	✓

Economic compatibility

Relative tooling cost	medium			
Relative equipment cost	high			
Labor intensity	medium			
Economic batch size (units)	1	-	1e7	

Physical and quality attributes

Mass range	0.001	-	5.5e4	kg
Range of section thickness	0.2	-	500	mm
Tolerance	0.013	-	0.4	mm

Roughness	0.5 - 25 µm
Surface roughness (A=v. smooth)	B

Process characteristics

Primary shaping processes	✗
Machining processes	✓
Cutting processes	✓
Discrete	✓
Prototyping	✓

Supporting information

Design guidelines

Turning is a versatile process, allowing intricate shapes, high precision and finish , but at a cost.

Technical notes

It is possible to turn almost all metals and some plastics and ceramics, but these require diamond-tipped tools. The process is not limited by length-to-diameter ratio of shafts or holes; with the workpiece properly supported, shafts and holes having a length-to-diameter ratio (or vice versa) by a factor of 50 or more can be turned or bored.

Typical uses

Turning is used to machine any component that requires axisymmetric elements. Almost all engineering components are subjected to some degree of machining. Examples are: engine and transmission housings, pistons, pins, gears, shafts, rivets, valves and pipe fittings; screws and fasteners.

The economics

Any production quantity is economic. Equipment varies from manual lathes for small quantities to multiple-spindle numerically controlled systems for very high production levels.

The environment

Lubricants and cutting fluids can pose an environmental problem. Special precautions are essential when machining composites because of glass or carbon dust, and when machining toxic materials such as beryllium.

Links

MaterialUniverse

Reference