Description

Image

Image caption

(1) Worker sandblasting wearing full coverage protective gear © National Institute for Occupational Safety and Health (NIOSH) (2) Pressfittings deburring tool © Sarang at Wikimedia Commons [Public domain]

The process

In ABRASIVE JET MACHINING material is removed from workpieces by a high speed stream of abrasive particles in an air or gas jet. The jet is focused through a nozzle made of tungsten or sapphire to resist abrasion. It is used for machining delicate or very hard materials. The process has the advantage of producing no heat damage to workpiece surfaces. A taper is produced in deep cuts. The distance of the nozzle from the workpiece affects the size of the machined area and the removal rate.

Process schematic

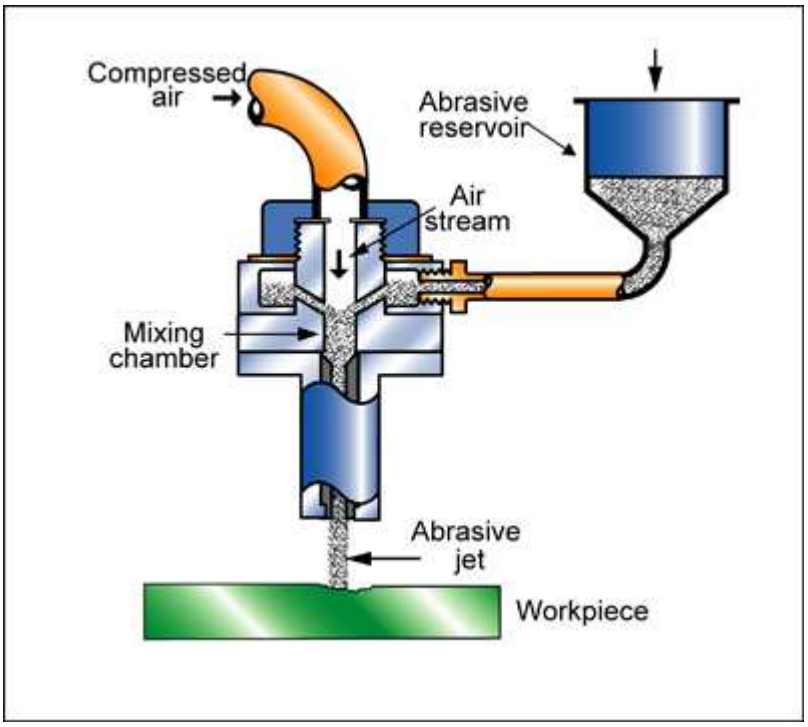

Figure caption

Abrasive jet machining. Abrasive particles are entrained in a fast gas stream and impinge on the workpiece.

Tradenames

AJM, AJC,

Material compatibility

Ceramics	✓
Glasses	✓
Metals - ferrous	✓
Metals - non-ferrous	✓

Shape

Circular prismatic	✓
Non-circular prismatic	✓
Flat sheet	✓
Dished sheet	✓
Solid 3-D	✓
Hollow 3-D	✓

Economic compatibility

Relative tooling cost	low			
Relative equipment cost	medium			
Labor intensity	high			
Economic batch size (units)	1	-	1e6	

Physical and quality attributes

Mass range	0.1	-	100	kg
Range of section thickness	1	-	20	mm
Tolerance	0.05	-	0.13	mm
Roughness	1	-	3	µm
Surface roughness (A=v. smooth)	A			

Process characteristics

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

Supporting information

Design guidelines

AJM is used both for machining and for cutting. Taper in the walls of cuts -- about 0.05 mm per 10 mm of cut depth -- is inherent and increases as nozzle/work spacing increases. Cuts cannot be made adjacent to steps or bosses because access is required for the nozzle.

Technical notes

AJM is used to machine hard or brittle materials such as glass, porcelain, silicon and other ceramics, tungsten and hardened steels.

Typical uses

Deburring , trimming and deflashing of machined parts, cleaning, polishing, texturing of surfaces. Trimming resistors to precise values, cutting of silicon semiconductors, cutting of heat-sensitive components.

The economics

The equipment for AJM is inexpensive and tooling costs low, but the process is slow so is only used when faster methods are unsuitable (due to the nature of the workpiece material) or the cutting time is insignificant in the overall manufacturing cycle.

The environment

The process involves airborne particulates so some protective equipment is required for personnel operating the equipment.

Links

MaterialUniverse

Reference