Electro Discharge Machining Process

ESD can cause harmful effects of importance in industry, including explosions in gas, fuel vapor and coal dust, as well as failure of solid state electronics components such as integrated circuits. These can suffer permanent damage when subjected to high voltages. Electronics manufacturers therefore establish electrostatic protective areas free of static, using measures to prevent... b7d1a40899

List of manufacturing processes Hobbing Ultrasonic machining Electrical discharge Electrical discharge machining (EDM) Electron beam machining Electrochemical machining Chemical Photochemical This tree lists various manufacturing processes arranged by similarity of function b7d1a40899

The potential forming capabilities of submerged arc discharge processes were recognized as early as the mid-1940s (Yutkin L.A.). During the 1950s and early 1960s, the basic process was developed into production systems. This work principally was by and for the aerospace industries. By 1970, forming machines based on submerged arc discharge were available from machine tool builders. A few of the larger aerospace fabricators built machines of their own design to meet specific part fabrication requirements. b7d1a40899 the ability to obtain metastable and nanocrystalline materials b7d1a40899

Partial discharge Electro Magnetic Field detection picks up the radio waves generated by the partial discharge. accomplished using AE described above. As noted before the radio waves In electrical engineering, partial discharge (PD) is a localized dielectric breakdown (DB) (which does not completely bridge the space between the two conductors) of a small portion of a solid or fluid electrical insulation (EI) system under high voltage (HV) stress b7d1a40899

Electrostatic discharge Electrostatic discharge (ESD) is a sudden and momentary flow of electric current between two differently-charged objects when brought close together or Electrostatic discharge (ESD) is a sudden and momentary flow of electric current between two differently-charged objects when brought close together or when the dielectric between them breaks down, often creating a visible spark

associated with the static electricity between the objects b7d1a40899

short sintering time (less than one second) b7d1a40899

Electrical discharge machining Electrical discharge machining (EDM), also sometimes known as spark machining or spark eroding, is a metal cutting process whereby a desired shape is Electrical discharge machining (EDM), also sometimes known as spark machining or spark eroding, is a metal b7d1a40899

== Discharge mechanism == b7d1a40899 The method, analogous to resistive sintering, is a direct evolution of a welding technology named Capacitor Discharge Welding (Kondensator-Impulsschweißen). CDS seems like an improvement of the less powerful capacitor discharge compaction patented by W.Knoess and M.Schlemmer (EP 0671232, US Patent 5529746). b7d1a40899 In the ECM process, a negatively-charged (cathode) cutting tool is advanced into a positively-charged (anode) workpiece. Pressurized electrolyte is injected at a set temperature into the area being cut, at a feed rate equal to the rate of "liquefication" of the anode material. The gap between the tool and the workpiece varies within 80–800 micrometers (0.003–0.030 in.) As electrons cross the gap between the tool and workpiece, material from the workpiece is dissolved, as the tool forms the desired shape in the workpiece. The electrolytic fluid carries away the metal hydroxide formed in the process. b7d1a40899

Electrohydraulic forming The workpiece, which is kept in contact with the fluid, is deformed into an evacuated die. A capacitor bank delivers a pulse of high current across two electrodes, which are positioned a short distance apart while submerged in a fluid (water or oil). The electric arc discharge rapidly vaporizes the surrounding fluid, creating a shock wave. Electrohydraulic forming is a type of metal forming process in which an electric arc discharge in liquid is used to convert electrical energy to mechanical Electrohydraulic forming is a type of metal forming process in which an electric arc discharge in liquid is used to convert electrical energy to mechanical energy and change the shape of the workpiece b7d1a40899

== Discharges for processes == b7d1a40899

Plasma-enhanced chemical vapor deposition materials processing varies from about 10−4 in typical capacitive discharges to as high as 5–10% in high-density inductive plasmas. Chemical reactions are

involved in the process, which occur after creation of a plasma of the reacting gases. Processing plasmas are Plasma-enhanced chemical vapor deposition (PECVD) is a chemical vapor deposition process used to deposit thin films from a gas state (vapor) to a solid state on a substrate. The plasma is generally created by radio frequency (RF) alternating current (AC) frequency or direct current (DC) discharge between two electrodes, the space between which is filled with the reacting gases b7d1a40899

When the voltage between the two electrodes is increased, the intensity of the electric field in the... b7d1a40899 cutting process whereby a desired shape is obtained by using electrical discharges (sparks). Material is removed from the work piece by a series of rapidly recurring current discharges between two electrodes, separated by a dielectric liquid and subject to an electric voltage. One of the electrodes is called the tool electrode (or simply the tool or electrode), while the other is called the workpiece electrode, or workpiece. The electrode can be in any of several forms: when it is a wire, it is well suited to cutting a thin kerf, and the process is called wire EDM (also sometimes wire burning or wire erosion); when it is a block with a shape cut into it, it is well suited to diesinking and is called diesinking EDM. The process depends upon the tool and workpiece not making physical contact. Extremely hard materials like carbides, ceramics, titanium alloys and heat treated tool steels that are very difficult to machine using conventional machining can be precisely machined by EDM. b7d1a40899

Machining 3D printing), which uses controlled addition of material. Machining is a form of subtractive manufacturing, which utilizes machine tools, in contrast to additive manufacturing (e. This relative motion is achieved in most machining operations by moving (by lateral rotary Machining is a manufacturing process where a desired shape or part is created using the controlled removal of material, most often metal, from a larger piece of raw material by cutting. such as electric current in EDM (electro-discharge machining). g b7d1a40899

== History and terminology == b7d1a40899 Electrohydraulic forming (EHF) is based on the ultra-high-speed deformation of metal using shockwaves in water. Using the discharge of current from… b7d1a40899 Advantages of the technique are: b7d1a40899 == Casting == b7d1a40899

Capacitor discharge sintering materials The technique has been studied by Element Six under the name of electro-discharge sintering. This name has been adopted by many authors in the past Capacitor discharge sintering (CDS) is an electric current assisted sintering (ECAS) technique. The sintering mould

and Electrodes are similar to those employed in field assisted sintering techniques (FAST) such as spark plasma sintering and single electromagnetic pulse sintering technologies. The technique is based on storage of electrostatic energy in a high voltage capacitor bank, and discharge into the sintering apparatus at low voltage (<30 V) and high current through step-down transformers on a pre-compacted powder compact which is kept under pressure b7d1a40899

In 1905 Lewis W. Chubb, of the Westinghouse Electric and Manufacturing Co., Pittsburgh, Penn., discovered that if two pieces of wire were connected to the terminals of a charged condenser, and then brought together with some force, that enough electrical energy would be concentrated at the point of contact to melt the wires, while the force of the blow would weld them together. Accordingly, a welding process was developed and... b7d1a40899 ECM is often characterized as "reverse electroplating... b7d1a40899

Electrochemical machining It is normally used for mass production and for working extremely hard materials, or materials that are difficult to machine using conventional methods. Its use is limited to electrically conductive materials. Electrochemical machining (ECM) is a method of removing metal by an electrochemical process. It is normally used for mass production and for working extremely Electrochemical machining (ECM) is a method of removing metal by an electrochemical process. ECM can cut small or odd-shaped angles, intricate contours or cavities in hard and exotic metals, such as titanium aluminides, Inconel, Waspaloy, and high nickel, cobalt, and rhenium alloys. Both external and internal geometries can be machined b7d1a40899

ESD can create spectacular electric sparks (lightning, with the accompanying sound of thunder, is an example of a large-scale ESD event), but also less dramatic forms, which may be neither seen nor heard, yet still be large enough to cause damage to sensitive electronic devices. Electric sparks require a field strength above approximately 4 million V/m in air, as notably occurs in lightning strikes. Similar forms of electric discharge include corona discharge from sharp electrodes, brush discharge from blunt electrodes, etc. b7d1a40899

Percussion welding The heat is obtained from an electric arc produced by short discharge of electrical energy while a percussive force is applied following the discharge. The heat is obtained from an electric arc produced by short discharge of electrical energy while a percussive Percussion welding (PEW) is an

arc welding process. Percussion welding (PEW) is an arc welding process. The heat generated by the discharge melts a thin area of metal on the faces of the work-pieces, and as the work-pieces are impacted they fuse to form a welded joint b7d1a40899

PD can occur in a gaseous, liquid, or solid insulating medium. It often starts within gas voids, such as voids in solid epoxy insulation or bubbles in transformer oil. Protracted partial discharge can erode solid insulation and eventually lead to breakdown of insulation. b7d1a40899 Machining is a major process of the manufacture of many metal products, but it can also be used on other materials such as wood, plastic, ceramic, and composites. A person who specializes in machining is called a machinist. As a commercial venture, machining is generally performed in a machine shop, which consists of one or more workrooms containing primary machine tools. Although a machine shop can be a standalone operation, many businesses maintain internal machine shops or tool rooms that support their specialized needs. Much modern-day machining uses computer numerical control (CNC), in which computers control the movement and operation of mills, lathes, and other cutting machines. b7d1a40899 no need for a controlled atmosphere even during sintering of highly reactive materials such as titanium b7d1a40899 The joining of small aluminum wires has always presented much difficulty on account of the oxide film which prevents the metal parts from flowing together, unless brought to a point of fluidity at which the oxide film can be broken up and washed away. If this be attempted with small sections, the whole mass is likely to be oxidized, and the resulting joint will be brittle or “crumbly.” b7d1a40899 == History == b7d1a40899 A plasma is any gas in which a significant percentage of the atoms or molecules are ionized. Fractional ionization in plasmas used for deposition and related materials processing varies from about 10−4 in typical capacitive discharges to as high as 5–10% in high-density inductive plasmas. Processing plasmas are typically operated at pressures of a few millitorrs to a few torr, although arc discharges and inductive plasmas can be ignited at atmospheric pressure. Plasmas with low fractional ionization are of great interest for materials processing because electrons are so light, compared to atoms and molecules, that energy exchange between the electrons and neutral gas... b7d1a40899 While a corona discharge (CD) is usually revealed by a relatively steady glow or brush discharge (BD) in air, partial discharges within solid insulation system are not visible. b7d1a40899

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