

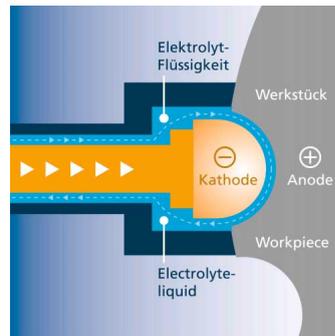
Making hundreds of non-round, curved holes in a few minutes

Not only round openings, but also hundreds of square, rectangular and hexagonal surfaces or elliptically curved holes can be produced in no time with the shape-producing ECM process.

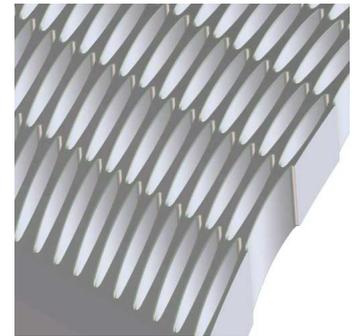
ECM (electrochemical machining) is also provably cheaper to operate than erosion or milling processes. Moreover, it permits holes to be machined at an oblique angle to the surface, which always leads to problems with conventional

cutting methods due to tool run-off.

However, unlike erosion processes, ECM does not use an electric arc for metal removal. Nor does it cause any tool wear. As it removes the metal in a very gentle manner, ECM does not produce any burrs, strains or surface alterations, such as hardness increases or so-called recast layers. Using ECM, manufacturers can thus produce thousands of recesses with identical geometries and properties. In a concrete case, 750 elliptical holes measuring



ECM operating principle

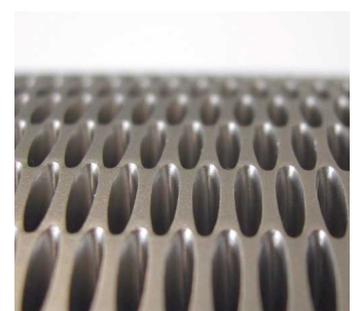


ECM permits holes to be machined into curved surfaces at oblique angles, which always leads to problems with conventional cutting methods.

2.5 mm wide x 7 mm long x 4 mm deep were produced in a single 2-minute operation at Köppern GmbH of Hattingen, Germany. Hole and surface structures of this type are quite common on aviation and power plant components. The materials used for such applications are hard-to-machine steels and special nickel-based alloys. The specific workpiece involved had a surface quality of R_a 0.8 and a machining tolerance of ± 0.1 mm. The hourly rate of ECM machine operation amounted to €210. Based on the net machining time of 2 min., each machining operation – producing 750 holes – cost as little as 7 € or 1 cent per hole.

The ECM process

ECM or electrochemical machining is a shape-reproducing process. The tool and workpiece are attached as electrodes to the positive and negative poles of an 8 to 20-volt DC source. The gap between the tool and the workpiece is between 0.05 and 2 mm. Through this gap, an aqueous electrolyte solution is pumped.



750 elliptical holes measuring 2.5 mm wide x 7 mm long x 4 mm deep are produced in a single 2-minute operation.

As the tool moves forward – usually at a rate of 0.5 to 10 mm/min – the electrochemical process taking place in the area of the gap dissolves the material locally, causing the workpiece to assume the positive shape of the tool, while leaving the surface texture of the workpiece unaffected. The maximum process temperature is 80°C. Maschinenfabrik Köppern produces and supplies fully ECM-machined parts with unit weights of 20 g to 4,000 kg.



ECM machines produce fully ECM-machined, ready-to-use parts with unit weights of 20 g to 4,000 kg.

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