Technical Spotlight

Submitted by

Company **ERMO;** Zone Artisanale. – BP 15 – 53440 Marcillé-la-villé, France

Machine **Agie Integral 3 and Sodick**

Electrode **POCO EDM-200**

Application **Printer Components**

A total of 450 electrodes were needed to make this mould. Each electrode shape required three electrodes – roughing, semi-finishing, and finishing electrodes. Electrode machining time was 340 hours.

The EDM machining time was 850 hours. The cavity tolerances were +/- .02mm. Surface finish was um Ra 1.8.

New Technology and Old-Fashioned Pride in Workmanship Makes ERMO Grow

The company started in 1979 by Mr. Jean-Yves Pichereau – today, Groupe ERMO is made up of 5 firms with 160 employees. Introduced on French Stock-Market since June 1998, they specialize in technical moulds for electrical devices, medical devices, automotive accessories and small appliance bodies.

ERMO has invested in new technologies to make quality moulds in order to compete in international markets. The latest expansion is in their design and analysis group where they work closely with customers to develop finished parts from concept through finished moulds. Plastics specialists study the thermal transfer and make design suggestions to get better function and reduce cost. They design around the movement of plastic. As the part cools, the plastic will pull in to keep straight, flat parts.

They were the first mould producer in France to have ISO 9002 certification. They believe that the first step in quality is a good environment. The working areas are well planned and clean. Each operator takes particular pride in the condition of his equipment and space, since one person works on each machine and considers it his machine.

Seven years ago ERMO changed from copper to graphite electrodes and feel that they have had less problems with graphite electrodes. Today, their electrodes are 99% graphite. They only use copper electrodes for gates on moulds. The polishing department polishes the graphite electrodes as well as the moulds to a mirror finish. Machine programming and set-up are done during the day and machines run unattended at night.

Their quality control department uses a 3D measuring system to compare measurements with the 3D model on their computer system.

One department at ERMO works only with problems on moulds. To support their customers they can make changes within 24 hours to get the mould back in production. This same department also does mould prototyping. Generally it takes from two to four weeks to make prototype moulds. They make adjustments to improve cycle times and produce good parts. For very technical parts, the first cavity that is built is a trial cavity that is reworked until it is correct. Dimensional controls are critical on finished parts. The trial cavity is scrapped and the adjustments are incorporated in the final mould.

ERMO is dedicated to producing quality moulds to serve their customers' needs.

Is Graphite Dust Harmful?

This question is frequently asked when the subject of graphite machining is discussed. In order to answer the question, we need to look at the different kinds of exposure that can affect the human body. The following information will provide the reader with a better understanding of graphite and graphite dust.

There are two types of graphite – natural and synthetic. The graphite used to fabricate EDM electrodes is synthetic graphite and the dust created by the machining process is classified as a biologically inert nuisance dust.

Human Body

Graphite is sometimes used for medical purposes in the human body. POCO's graphite materials are used in the manufacture of artificial heart valves. Radioactive graphite pellets are also implanted in the body to treat early-stage prostate cancer as well as thyroid gland problems.

We asked Don Elam, POCO's Health and Safety Coordinator, about the health effects of graphite dust. Don explains that, "Graphite dust may be

irritating to the eyes and may cause stinging, watering, and redness. Contact with dust may be abrasive and mildly irritating to the skin, but absorption of graphite dust by the skin is unlikely. The recommended first aid is to flush the affected area with clean water. As with other dusts, breathing graphite dust may aggravate existing respiratory problems. Since our dust collection systems keep the airborne dust concentration below the established exposure limits, the only personal protective equipment used by POCO machinists are safety glasses."

There is always some form of health effect associated with overexposure to any type of nuisance dust. In the U.S.A., product manufacturers provide Material Safety Data Sheets (MSDS) to their customers. One of the items listed on the MSDS is the exposure guideline for airborne concentrations of graphite dust. The Occupational Safety & Health Administration (OSHA) established these exposure guidelines. For any health effects to occur from synthetic graphite dust, exposures must be very high. The exposure guidelines for time-weighted average (TWA) for total airborne dust is 10 mg/m3 and TSW respirable fraction is 5 mg/m3. Some European and Asian countries have similar limits. At this concentration, the graphite dust would be so thick that visibility would be difficult. It is unlikely that this concentration would occur in the manufacturing or machining of graphite if a dust collection system is utilized. POCO has air quality samples taken on a regular basis to monitor the concentration of airborne dust.

Overexposure to graphite dust can cause a chronic and more serious condition known as graphitosis, which is a form of pneumoconiosis. This condition arises when respirable particles of graphite are retained in the lungs and bronchi. Hazards such as graphitosis have typically been associated with **natural** graphite, but in rare instances have also been associated with synthetic graphite. Most synthetic graphites do not contain crystalline silica that is found in natural graphite.

The Environment

Graphite is a chemically inert material and contains no volatile components. It is not harmful to the environment. Spontaneous combustion is not possible. Graphite does not melt and cannot be dissolved. Graphite will oxidize at temperatures above 430 degrees C in an oxygen atmosphere creating CO or CO2.

Machinery

Dust collectors are recommended for cleanliness and appearance, as well as the continued long-term operation of machinery. Graphite dust is highly conductive and will cause damage to electrical systems if it is allowed to get inside the machine. Graphite is also abrasive to machining surfaces and can cause loss of accuracy if dust is allowed to build up on precision surfaces and glass gauges.

Caution
Graphite impregnated with another material – follow the health and safety guidelines specific to the particular impregnated graphite.
Copper impregnated graphite is commonly used as an electrode material.

Sources: Govt. Reports Announcements & Index (GRA&I), Issue 10, 1989.
Gloria Hathaway, et al., P & H Chemical Hazards of the Workplace, Van Nostrand Reinhold, 1991, 314-315.
OSHA Regulation Preamble Air Contaminants, Section 6, Health Effects Discussion and Determination of Final Permissible Exposure Level (PEL).

Machining Tip

Controlling graphite dust

There are two methods for controlling graphite dust during the machining process. The first method is to use high air velocity with a dust collector. Conventional machining centers such as mills and grinders can be equipped with fixed or portable dust collection units. Portable dust collections are ideal for shops that only do a limited amount of graphite machining because the unit can be moved to various machines as needed. For shops doing high volumes of graphite machining, fixed units on each machine are the best solution.

Recommended speed for capturing dust is an air velocity of 500 feet per minute and in the dust collector lines, air should travel at a rate of 2,000 feet per minute to keep the dust from settling out of the air stream inside the duct work. The air velocity is determined by the amount of graphite dust in the air, which relates to the rate of material removed at each machine. POCO's graphite machining operations recommend *Industrial Ventilation: A Manual of Recommended*

Practice by the American Conference of Governmental Industrial Hygienists, as a source for information on designing dust collection systems.

Some high-speed graphite machining centers will have a built-in system that evacuates the dust with a powerful vacuum during the machining process.

The second method of dust collection is the wet graphite machining process. Directed streams or fluid curtains around the spindle can be used to trap the dust before it becomes airborne. There are several systems on the market that can be easily installed on new or existing equipment. These systems include a filtration system to remove the graphite sludge from the recirculating fluid.