

Tungsten Carbide Lip Coater

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Abstract

The purpose of our presentation today is to introduce our original slot die, Tungsten Carbide Lip Coater. In our presentation, we present an overview of our company, our carbide metallurgy and our slot die.

---Overview of Mitsubishi Materials---

Mitsubishi Materials Corporation was established in 1950, we are one of the world's largest diversified materials companies. Annual sales are about 14.5 billion dollars. Head office is Tokyo, Japan. We have about 20,000 employees, 239 operating subsidiaries and affiliates in 23 countries. Our company is listed on the Tokyo Stock Exchange. We have about 3,500 holding patents all over the world.

We are involved in various non-ferrous materials and processed goods, for example, cement, copper, aluminum, silicon, sputtering targets, absorption materials, high performance alloy and carbide tools.

---Mitsubishi Carbide Metallurgy---

Cemented carbide consists of Tungsten carbide phase, binders phase, for example, Co, Ni and so on. Hardness is HRA 80-95, harder than High speed steel and Die steel, tougher than Ceramics.

The figure is our cemented carbide manufacturing process. We can manufacture our original cemented carbide throughout.

Sub-micro-grain series that we use for our tungsten carbide lip coater is utilizing its excellent wear resistance due to high hardness and high compressive strength. The series is widely used for special wear-resistant applications.

---Slot dies for Thin Film Coating---

Slot dies can be utilized for various applications including: Magnetic Tape, FPD (CF/TFT), Functional Film, Optical Film, Solar Cells, Multi Layer Ceramic Capacitor, Li-ion Battery, and Fuel Cells.

At the moment slot dies are available in the following widths for production: Tungsten carbide lipped dies at a maximum of 3.1 meters and standard stainless steel at a maximum of 3.8 meters. Constraints in keeping straightness across the surface of the slot die define the maximums. Straightness of the surface is essential for uniformity in coating. The possible thickness parameters for coating material are a maximum of 0.1mm and a minimum of 20nm, measured dry.

Slot dies are best suited for thin film coating, uniform coating and wear material coating.

We will present a comparison between conventional stainless steel lips and tungsten carbide lip slot dies. IN particular we will focus on the following:

1. Wear resistance
2. Shock resistance
3. Edge sharpness
4. Surface roughness
5. Slit-width measurement data
6. Coating test data

Tungsten carbide lips allow for a micro level edge sharpness, the elimination of burrs on the coating edge, the ability to have a surface ground finish measuring below $2\mu\text{m/m}$ at the lip edge and a surface roughness of Rz $0.1\mu\text{m}$.

The methods used to measure such data include a proprietary non-contact inspection technology to measure the slit-width accurately. The inspection involves continual measurement along the full length of the slot die.

Further in order to compare uniformity in final coating thickness we calculated the flow in the manifold and the outflow speed distribution.

Biography

Mr.Hiroshi Iekda

1970 MA of polymer chemistry at KEIO University.

1970 HITACHI:Semicoductor division and engaged in photolithography.

2000 Tokyo Ohka Kogyo(TOK) :Coating equipment division and engaged in developing non-spinning coater using the die for large plate glass panel of FPD.

2005 Ryotec : engaged in promotion of the die for coating processes of solar cells and lithium or fuel batteries.

Mr.Toru Fukutomi

1999 BS of accurate mechanical engineering at CHUO University, Tokyo.

1999 Mitsubishi Materials: Design and R&D for Slot Die Coaters

2000 :Sales for Slot Die Coaters

2005 :Marketing for Slot Die Coaters (Main Market solar cells and lithium or fuel batteries)