



**Industrial Equipment**  
Electron beam source and power supply

Solutions for Innovation

# JEBG-BS/ JST-ST series

High-power Electron Beam



JEOL Ltd.

# High-power Electr

Roll to Roll WEB coating / Large area substrate vacuum deposition.

Heat source for vacuum melting of high melting point metals.

▶ **Wide area vapor deposition**

Wide area vapor deposition is realized by parallel operation of electron beam source.

▶ **High Thermal efficiency**

High melting point metals such as W, Ta and Mo can be easily melted.

▶ **High controllability**

EB scanning in material vapor environment has realized controllability and stability by the electromagnetic deflection.

▶ **Easy maintenance**

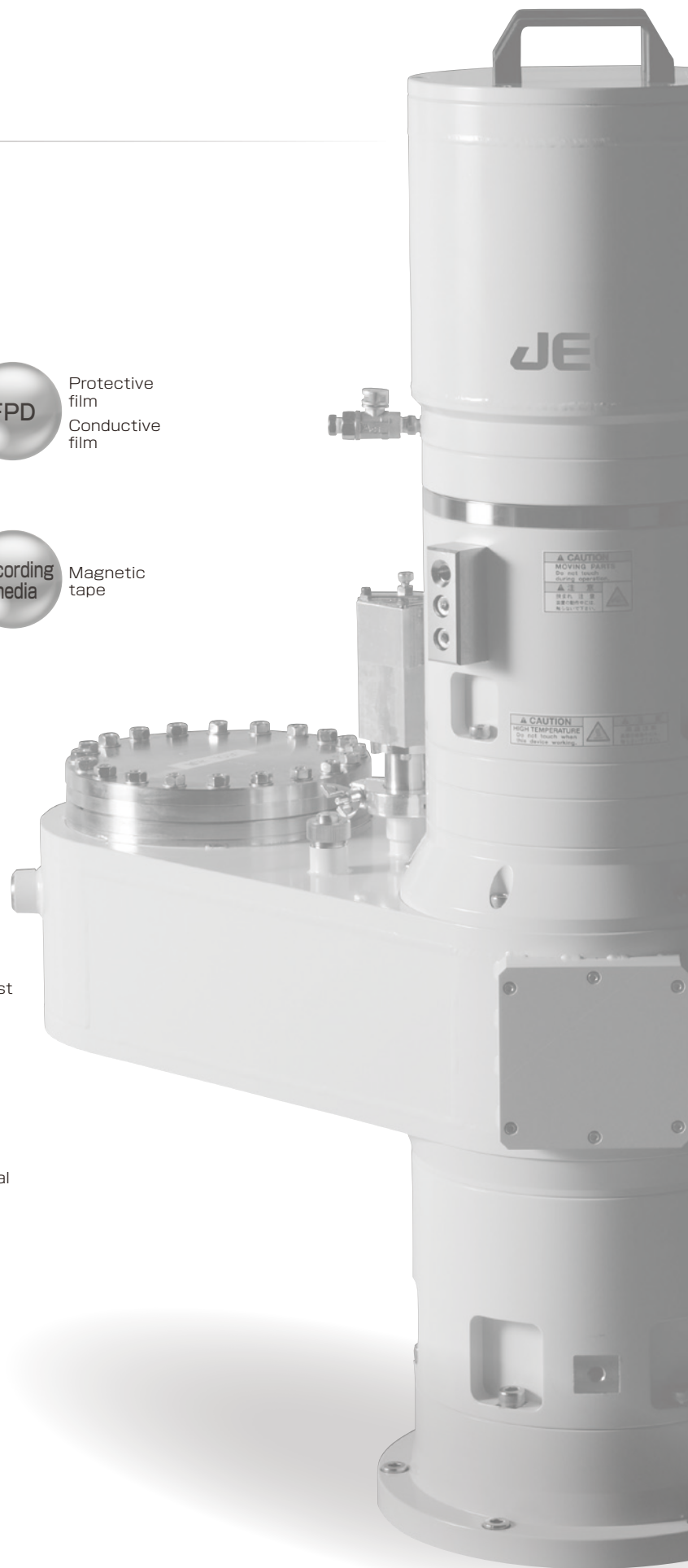
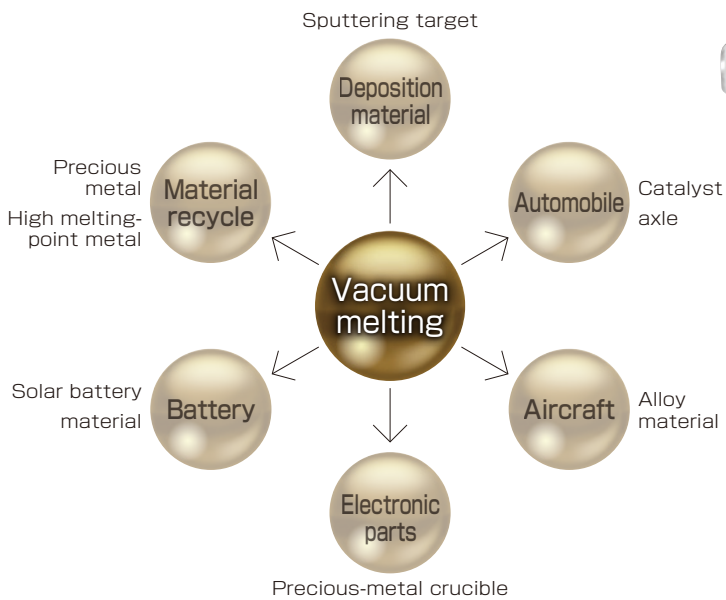
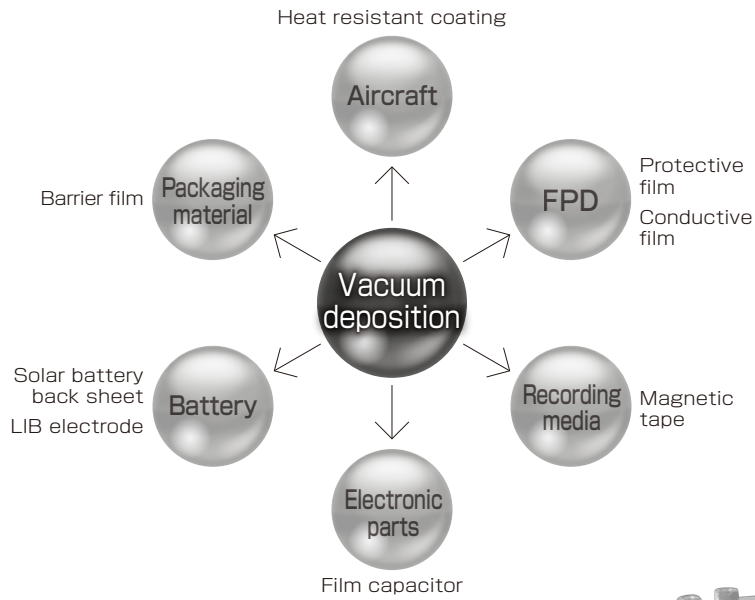
The air lock valve separates the vacuum between the electron beam source chamber and the sample chamber, so that the electron beam source chamber and the sample chamber can be maintained separately.

As the grid assembly is easy to replace, the electron beam source chamber can be opened to the atmosphere only for a short time.

▶ **Low vacuum operation**




Stable electron beam operation is possible even at a pressure of  $5 \times 10^{-2}$  Pa as it adopts a differential exhaust.

# on Beam



# Line Up

## Line up

		EBG-300UA	BS-40030GLA	JEBG-1000UB	JEBG-3000UB
Electron gun					
Type		thermal electron beam source			
Emitter		block cathode			
Emitter heating system		electron bombardment system			
Electron beam power		2 kW to 30 kW		3 kW to 100 kW	4 kW to 300 kW
Acceleration voltage		20 kV		30 kV	40 kV
Emission current		100 to 1500 mA		100 to 3400 mA	100 to 7500 mA
Deflection angle		±30 deg (X-Y2 axis Magnetic field type deflector)			
Deflection frequency		300 Hz		200 Hz	
Stigmator / Dynamic lens		×	○	△ <sup>※1</sup>	△ <sup>※1</sup>
Mass <sup>※2</sup>		about 120 kg	about 120 kg	about 220 kg	about 380 kg
Electron beam source power supply		ST-30BE2		JST-100C	JST-300CHR
Input power		3 Φ 200 to 220 VAC, 50/60 Hz, 45 kVA		3 Φ 400 to 440 VAC, 50/60 Hz, 150 kVA	3 Φ 400 to 440 VAC, 50/60 Hz, 400 kVA
Grounding		JIS A type earth, ground resistance 10 Ω or less.			
Dimension (mm)	High voltage transformer	972(W)×850(D)×933(H)		1290(W)×1090(D) ×1655(H)	1530(W)×1430(D) ×2068(H)
	Control rack	1250(W)×1024(D)×1750(H)		570(W)×760(D) ×1500(H)	640(W)×950(D) ×1850(H)
	Operation panel	481(W)×389(D)×149(H)		481(W)×389(D)×149(H)	481(W)×389(D)×149(H)
	TR-OFF	-		-	720(W)×720(D)×901(H)
Mass <sup>※3</sup>	High voltage transformer	about 500 kg		about 2500 kg	about 5000 kg
	Control rack	about 700 kg		about 250 kg	about 490 kg
	Operation panel	about 12 kg		about 12 kg	about 12 kg
	TR-OFF	-		-	about 200 kg

※1 Stigmator and dynamic lens are optional. ※2 without including the mass of turbo molecular pump exhaust system. ※3 The mass when the option is installed is different.

# Utilities

Electron gun		EBG-300UA	BS-40030GLA	JEBG-1000UB	JEBG-3000UB	
Electron beam source power supply		ST – 30BE2		JST – 100C	JST – 300CHR	
Input power	Electron beam source power supply	3 $\phi$ 200 to 220 V 50 / 60 Hz 45 kVA JIS A type earth		3 $\phi$ 400 to 440 V 50 / 60 Hz 150 kVA JIS A type earth	3 $\phi$ 400 to 440 V 50 / 60 Hz 400 kVA JIS A type earth	
	Oil cooler	–		3 $\phi$ 200 V ( $\pm$ 10%) 50 / 60 Hz 1 kVA		
	Operation and control related equipment	1 $\phi$ 100 V ( $\pm$ 10%) 50 / 60 Hz 1 kVA <sup>※1</sup>				
Required cooling water	Cooling water volume	Anode	9.0 to 10.0 L / min		10.0 to 11.0 L / min	10.0 to 11.0 L / min
		Lens	–		9.0 to 10.0 L / min	30.0 to 31.0 L / min
		High voltage transformer	–		9.0 to 10.0 L / min	30.0 to 31.0 L / min
	Pressure	0.3 MPa (Max)				
	Temperature	30 °C or less and Non-condensing				
	Quality	pH 6 to 8 (25 °C), Hardness : 170 ppm or less <sup>※2</sup>				
Required compressed air	Flow	30.0 L / min		70.0 L / min	70.0 L / min	
	Pressure	0.5 to 0.6 MPa				

※1 Conditions for using the PC system. When using the optional EB control rack, EB control panel, etc., about 2 kVA is required.

※2 There are more detailed regulations for water quality conditions. Please contact us for more information.

# Options

## ST-BEAMP1 Amplifier unit

### Dynamic Lens

The dynamic lens corrects to focus when the work distance is changed with electron beam scanning.

### Stigmator

The stigmator corrects EB projection shape changed with electron beam scanning.

## EBG-RSV50 View port

EBG-RSV50 is view port for observation into vacuum chamber for vacuum deposition or vacuum melting. This viewport is able to observe for a long time, as rotary slit disk suppresses vapor deposition to protection glass for observation window.



## 90 degree deflection system

When electron beam source is mounted to the side of vacuum chamber, 90 degree deflection system suppresses EB current density reduction, by adjusting electron beam incidence angle to target by creating magnetic deflection field.

### CONFIGURATION

Example: Electron beam source and power supply, main configurations

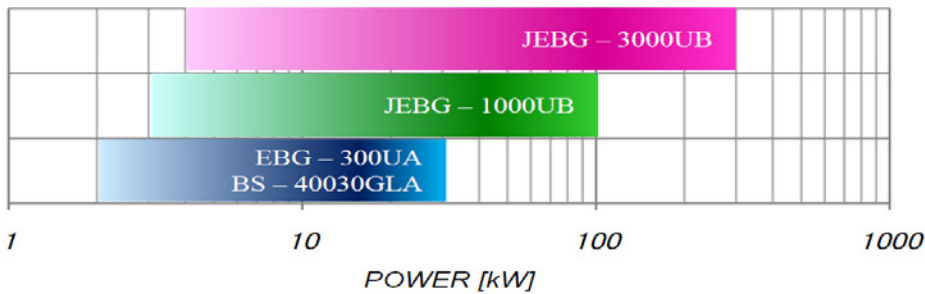
Control PC system, Software	High power electron beam source	EB source and power supply

# EB Source Selection

## EB source selection

### Power

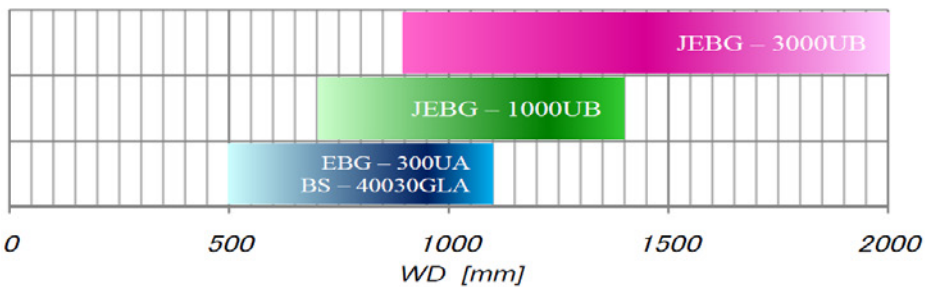
Three types of electron beam sources with different maximum output are available. Please select according to the input power of electron beam for materials. Since the resolution of the electron beam output setting is the same for each electron beam source, the setting is coarser for a higher power electron beam source.



### Work distance (WD)

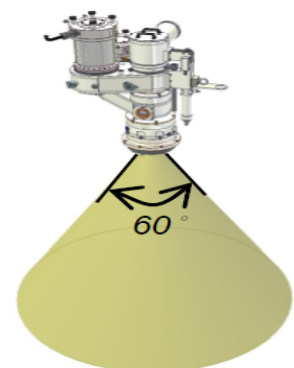
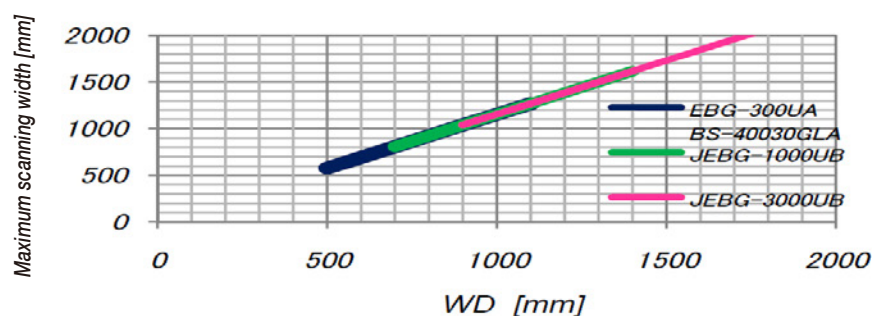
Each type of electron beam source has difference work distance (between electron beam source and the object to be irradiated).

The electron beam source mounting position must be carefully considered from needed power and EB scanning area.



### EB scanning area

The scanning area of electron beam source is within a conical shape with apex angle of 60 degrees for all models. A layout must be considered with a scanning area to cover the object to be irradiated and that there is no obstruction between electron beam source and the object to be irradiated.



# EB Scanning

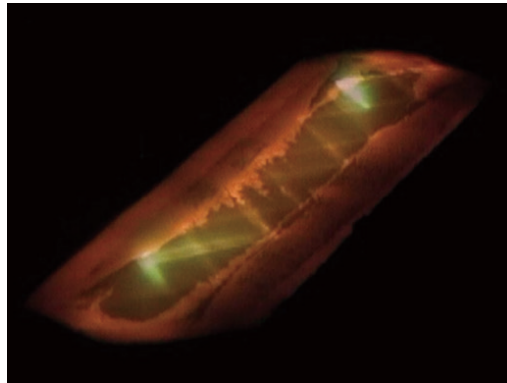
## Electron beam scanning

### EB deflection controller

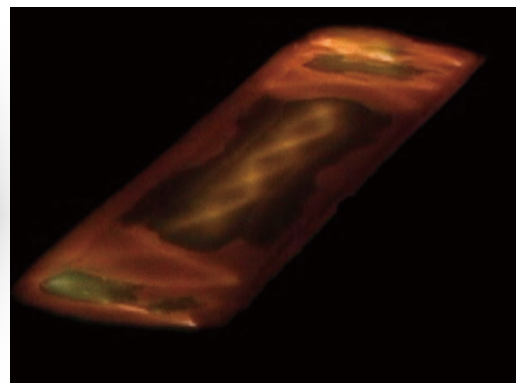
A variety of electron beam scanning patterns can be created by using an X-Y 2-axis scanning coil and a deflection controller (ST-500DC / ST-500DCH).



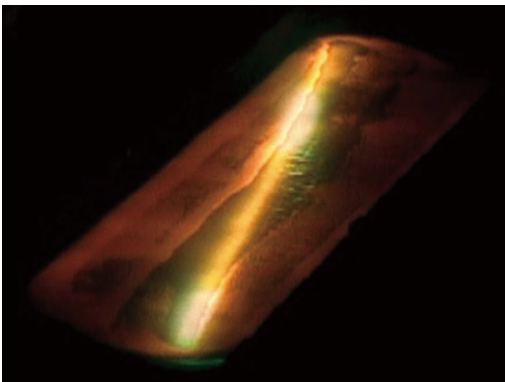
X direction line scanning



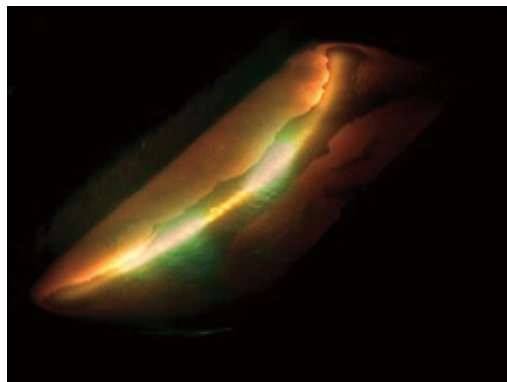
Y direction scanning superimposed to X direction line scanning



Decreased Y amplitude in EB scanning center



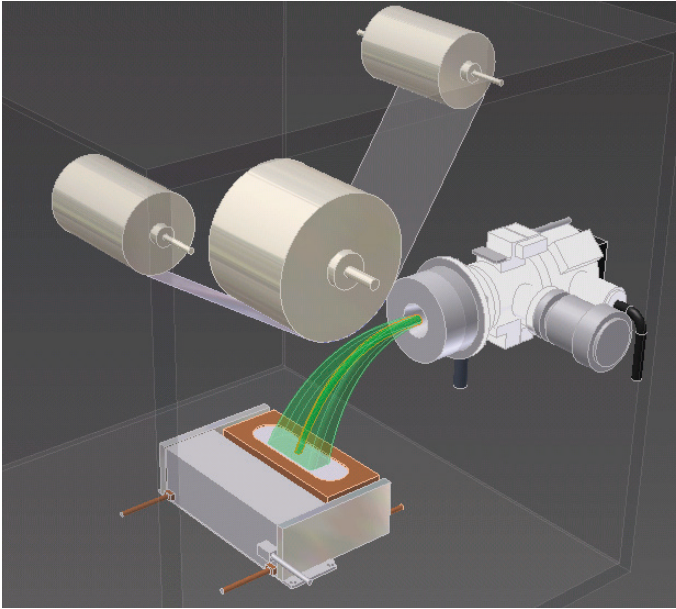
Rotation correction



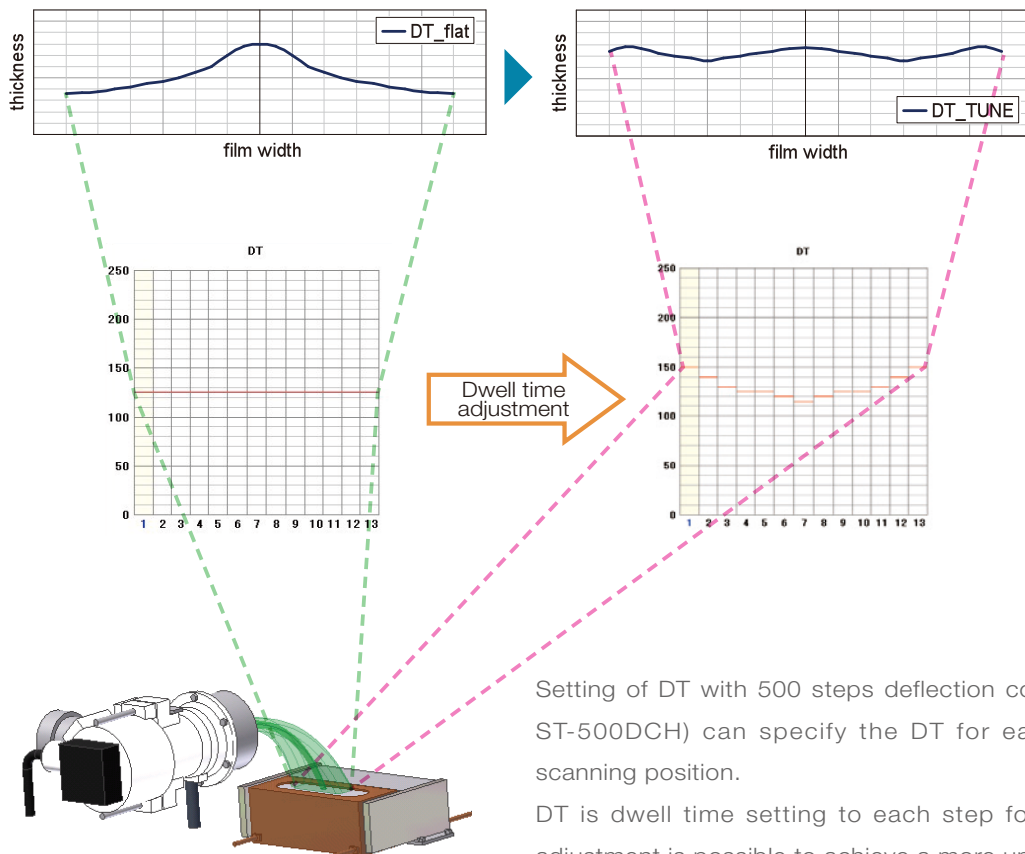
Arc correction

# Deposition

Application example: Vacuum deposition equipment



Electron beam source can deflect the electron beam by using an optional 90 degree deflection system. Electron beam source can be mounted on the side face of chamber that is not easily affected by vapors by using this system. It is used for large area glass deposition system, high barrier films roll coating system, and others.



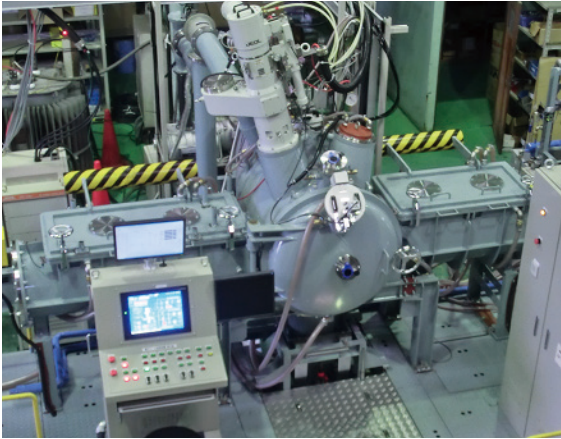
Setting of DT with 500 steps deflection controller (ST-500DC, ST-500DCH) can specify the DT for each electron beam scanning position.

DT is dwell time setting to each step for EB scanning. DT adjustment is possible to achieve a more uniform film thickness.



# Melting

Application example: EB melting furnace



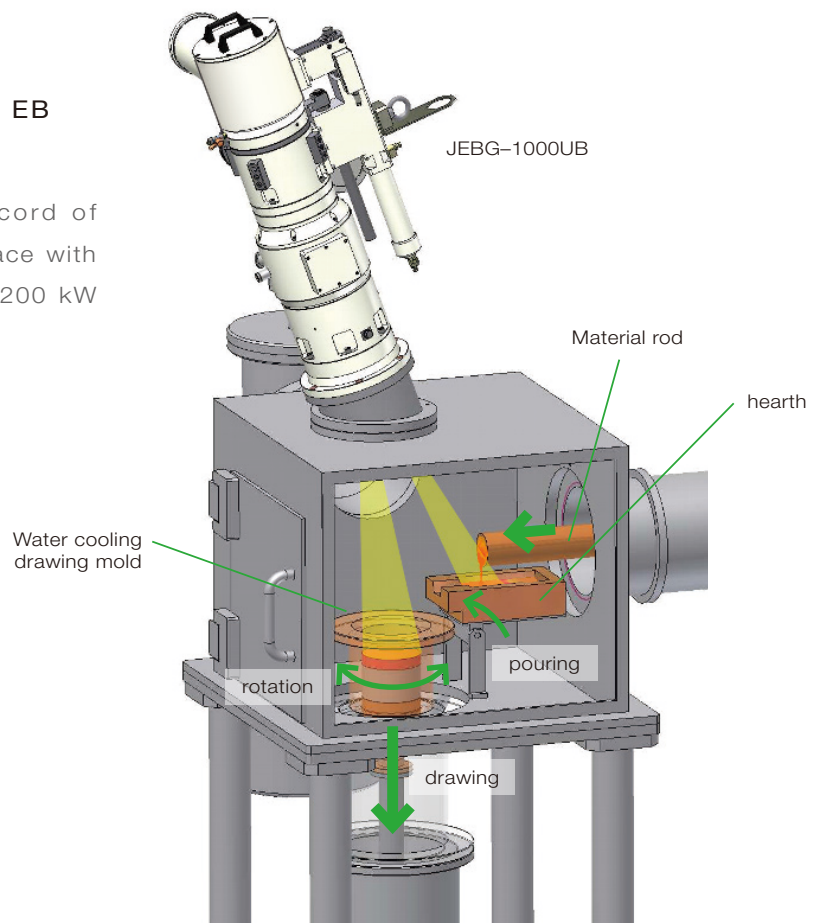
100 kW EB melting furnace (example)



1200 kW EB melting furnace (example)

## ■ Configuration diagram of EB drawing melting furnace

The series has a proven record of installation to EB melting furnace with maximum output 100 kW to 1200 kW (JEBG-3000UB x 4).



# Features

## EB melting: Features

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### ■ High melting point metals can be melted.

Max power of 300 kW high energy density electron beams that is focused by electromagnetic lens can be input to the materials. Therefore high melting point metals such as W, Ta, Mo can also be melted.

### ■ Active metals can be melted.

As the process is performed in a high vacuum, there is little deterioration in quality due to oxidation and other factors, making it possible to produce high quality ingots.

### ■ Capable of large area melting

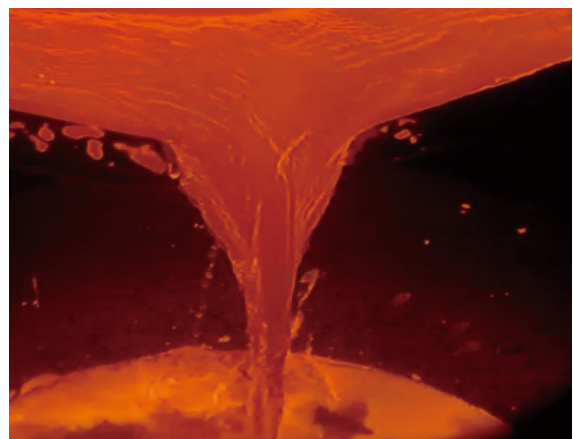
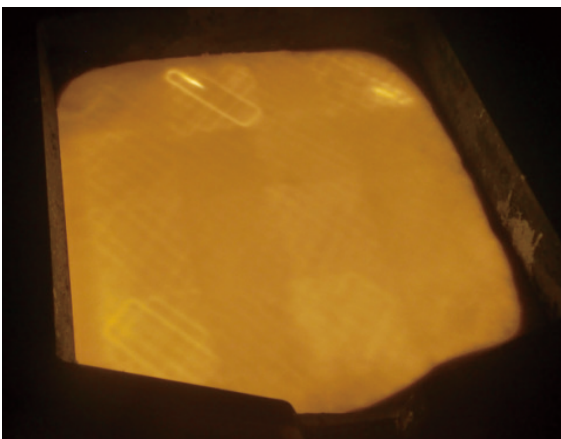
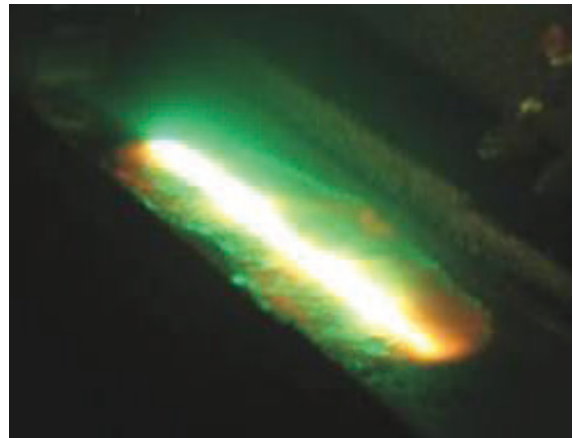
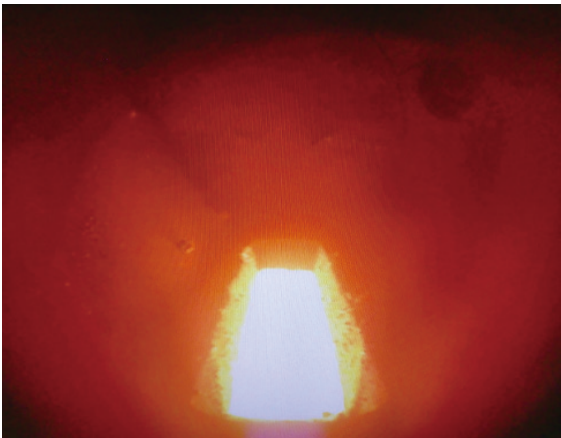
The electron beam of up to 300 kW scans the surface of the material using an electromagnetic coil, which allows the power to be applied to a larger area more easily than other processes.

A higher power EB melting furnace can be realized by irradiating a single hearth/crucible with multiple electron beam sources, thus enabling a large volume melting.

### ■ Capable of various product shapes

It can be used for various manufacturing processes such as metal melting in a boat crucible, laminated casting by hearth melting and pouring, and drawing melting.

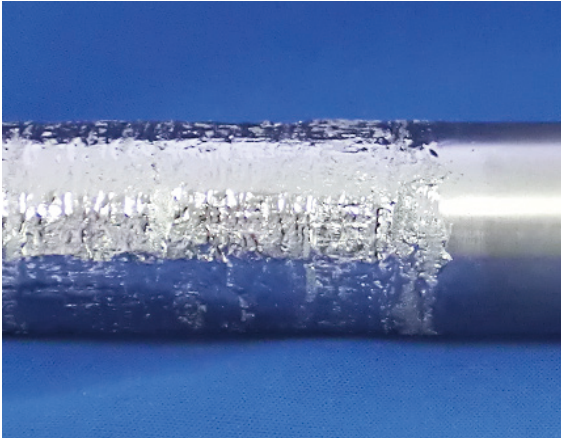
The electron beam scanning pattern can be varied for various shapes such as round, square and rectangular hearth.



# Examples

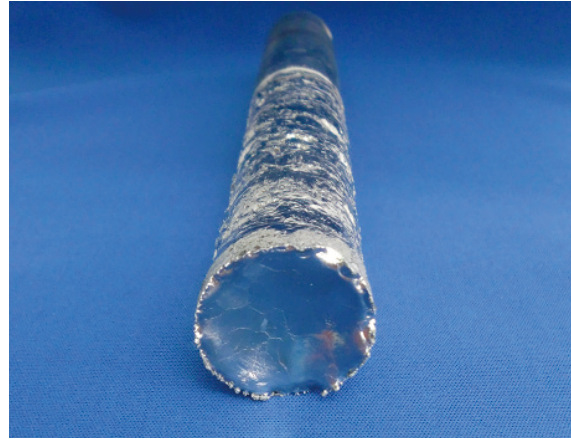
## EB melting: Examples

### ■ Drawing melting (high melting point metals)



Ta

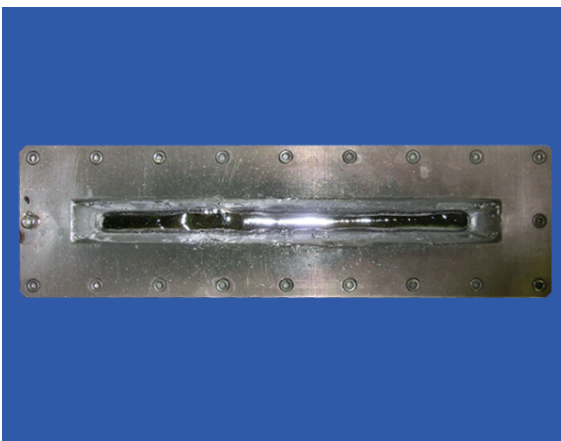
Size:  $\Phi 30$  mm  $\times$  L 80 mm  
Melting power: 30.4 kW  
Drawing speed: approx. 1.0 mm/min



Ti

Size:  $\Phi 30$  mm  $\times$  L 113 mm  
Melting power: 10.1 kW  
Drawing speed: approx. 2.0 mm/min

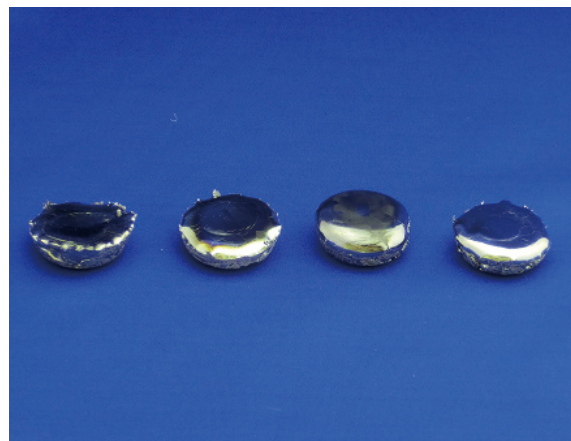
### ■ Boat melting



Ta

Size: 20 mm (W)  $\times$  10 mm (D)  $\times$  300 mm (L)  
Melting power: 29 kW

### ■ Button melting



Ti, Mo, Ta, W (from the left of picture)

size:  $\Phi 30$  mm  $\times$  D 15 mm

\* Specifications subject to change without notice.

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