

真空対応技術

Vacuum atmosphere compatible

日本航空電子工業株式会社
Japan Aviation Electronics Industry, Ltd.

真空対応技術

Vacuum atmosphere compatible

コンタミレスで作動

Dust free operation

対応真空度

Vacuum condition

10^{-7} Pa

The linear motor transfer stage for vacuum-compatible of semiconductor manufacturing equipment are increasingly required by microfabrication of semiconductor. Here, we would like to introduce the linear motor for Ultra High Vacuum.

リニアモータ

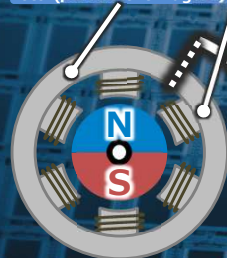
Linear motor

【原理】Principle

回転子(永久磁石)
rotor(permanent magnet)

固定子(コイル)
stator (coil)

可動子(永久磁石)
mover(permanent magnet)



直線に広げる
roll out

固定子を電磁石に
stator into electromagnet

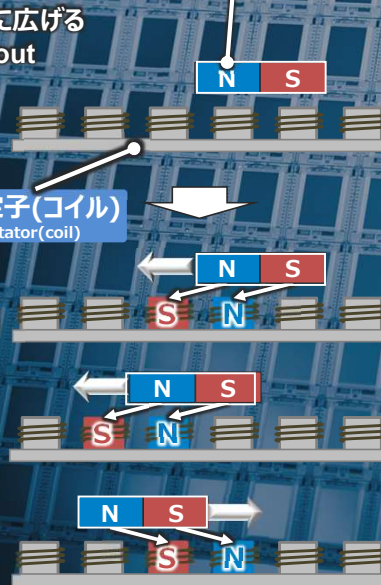
⇒可動子が移動(左移動)
the mover move left

磁極位置を移動
move magnetic pole to left

⇒更に移動(左移動)
the mover move left further

磁極位置を逆に移動
Move magnetic pole reverse

⇒逆方向に移動(右移動)
move right



【特長】Features

ギャップ精度
gap accuracy

【リニアモータの性能ファクタ】
performance key of Linear Motor

■ 可動子とコイルのギャップ精度

gap accuracy of between the mover and the coil

・ギャップが小さいほど大推力がだせる
narrower the gap, the greater the thrust

・コイルの寸法精度がキー
coil dimensional accuracy is key

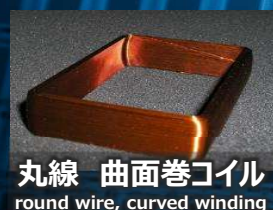
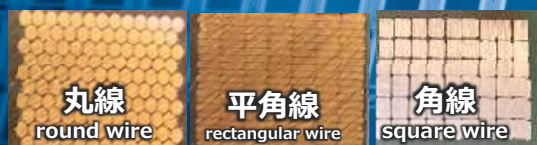
コイル製造に独自技術

Original technology for coil manufacturing

A linear motor is an electric motor that has had its stator and rotor "unrolled". The linear motor consists of a mover(permanent magnet)and a stator(coil), and the principle is that the mover moves by moving the magnetic poles of the coil. The narrower the distance(gap) between the mover (permanent magnet) and the coil, the linear motor will be more efficient. The dimensional accuracy of the coil is the key for high performance linear motor. JAE has achieved high performance of coils with its own technology for coil manufacturing.

高性能コイル

High performance coil



高占積率(高効率) High density (High efficiency)	丸線、平角線、角線に対応(占積率15%向上 平角/角線) Magnet wire, Rectangular, Square
高剛性 High stiffness	角線、ウェット巻き/真空含浸、FRP use to Square wire, wet winding, Vacuum pressure impregnation, FRP wrap
高い寸法精度 High dimension accuracy	ウェット巻きによる均一コイル面実現、高精度ギャップコントロール uniform coil surface by wet winding, precise gap control
各種冷却方法対応 Support many kind of cooling ways	空冷、液冷(HFE、純水)に対応(効率2倍アップ 純水) Available air cooling, liquid cooling(HFE, pure water) Thrust doubled by liquid cooling
防水性 waterproof	蒸着保護膜や特殊材料の含浸で完全防水実現 Waterproof by vapor-deposited film, special material.
形状 Form	あらゆる形状に対応可能(空芯コイル、鉄心コイル等) available core less coil, iron core coil

JAE has achieved highly efficient linear motor by the high performance of the coil. The larger the conductor area of the wire, the higher the performance of the coil. The round wires are usually used for coil, but the conductor area of rectangular wires and square wires is larger than that of round wires. The JAE manufactures coils using rectangular and square wires. But, since it is difficult to wind a rectangular wire or a square wire into a coil, it is difficult to improve the dimensional accuracy of the coil. JAE has realized a high-performance coil by solving the problem of manufacturing a coil with high dimensional accuracy with rectangular and square wires by using JAE original winding technology. In addition, JAE has technology for a waterproof coil based on coating, and JAE also has technologies for air cooling and liquid cooling.

真空対応技術

Technology of Vacuum atmosphere

真空対応構造

vacuum-compatible structure

シール構造・材料

seal, material

冷却管溶接構造

Cooling tube welding

コイル直冷/間冷

direct/indirect cooling

低漏洩磁束

Low leaking magnetic flux

補極、シールド

sub magnet, shield

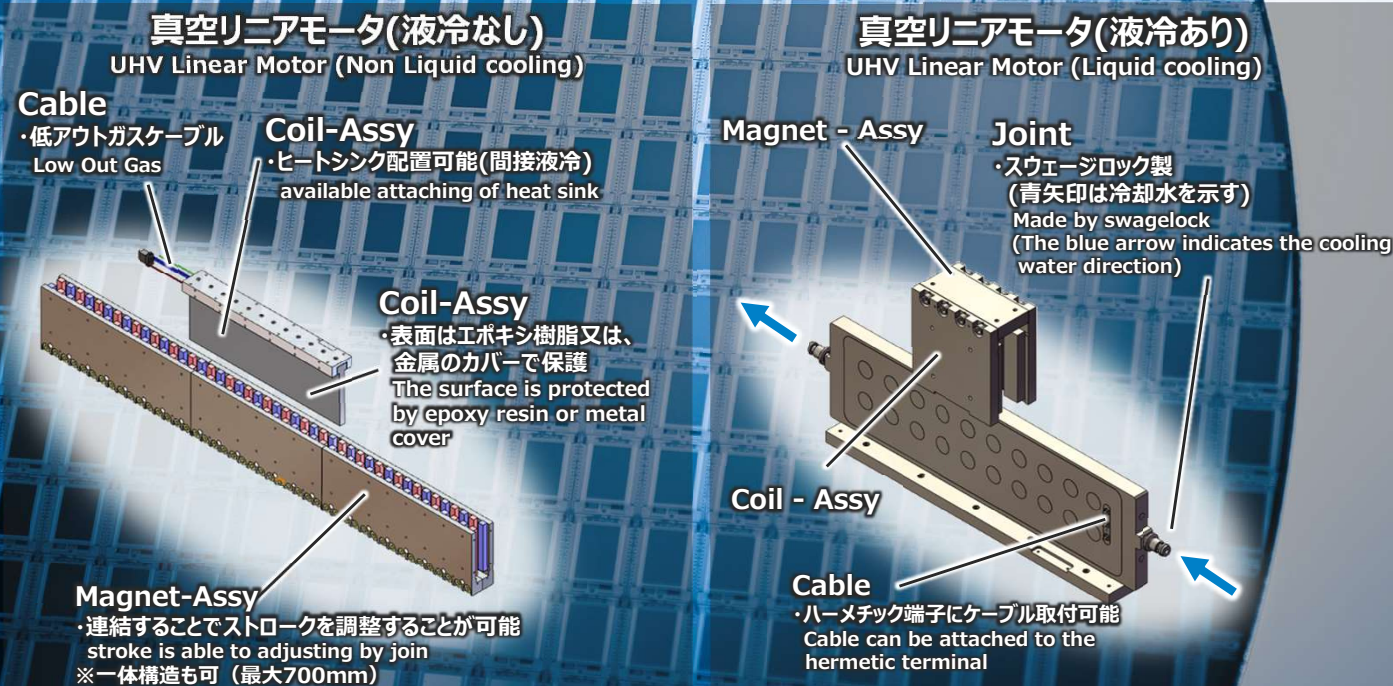
JAE selects materials with low outgas in order to suppress the generation of outgas that affects the degree of vacuum in the vacuum-compatible structure, and has adopted a structure that minimizes the exposure of materials that generate outgas. It can also be used for vacuum baking as a measure against outgas release. The cooling pipe welded structure is suitable for directly or indirectly liquid-cool the coil by keeping the heat generation of the coil lower. The airtight structure is suitable for a structure that is airtight only by welding without exposing any resin material such as O-rings and adhesives. Low leakage magnetic flux is realized by designing a magnetic circuit that suppresses leakage magnetic flux as much as possible so as not to distort the EB field. It can further low leakage magnetic flux reduction by covering with a shield plate.

真空対応リニアモータ

UHV Linear Motor

【特長】

- 低アウトガス
Low Out Gas
- 低温度上昇
Low temperature increase
- 低漏洩磁束
Low Leakage magnetic flux
- 高クリーン度
High cleanliness



This is an example of a vacuum linear motor. The features of this linear motor are low outgas, low temperature increase, low magnetic flux leakage, and high cleanliness. For low outgas, it is possible to further reduce outgas by using a proven resin material and cable and covering the entire surface of the motor with a metal plate. For low temperature increase, we design and produce coils (rectangular wire) with good heat dissipation in-house and realized indirect liquid cooling and direct liquid cooling. Liquid cooling is compatible with airtight structures by welding or O-rings. For low leakage magnetic flux, we design a magnetic circuit that supports low leakage magnetic flux with little effect on EB field.

真空対応リニアモータ

UHV Linear Motor

仕様 specification	単位 unit	冷却なし With cooling		冷却あり Non cooling
		マグネット分離タイプ Separate magnet	マグネット一体タイプ Integrate magnet	-
推力定数 Thrust constant	N/A _{0-p}	83.7	39.8	26.3
抵抗値/相間 Resistance	Ω	4.0	6.4	32.8
インダクタンス/相間 Inductance	mH	8.0	6.8	43.6
ストローク Stroke	mm	±335@3join	±229	±100
寸法(H D L) Dimension	mm	154×52×1035 @3join	81×36×714	139×62×416
冷媒 Refrigerant	-	-	-	純水 Pure water
駆動方式 Drive system	-	Moving magnet Moving coil	Moving magnet Moving coil	Moving magnet
ヒートシンク Heat sink	-	○ (ヒートシンク取付時：ムービングマグネット)	○ (ヒートシンク取付時：ムービングマグネット)	-

JAE provides the optimum UHV linear motor in terms of size, shape, etc. according to the customer's usage environment. If you have any problems with UHV linear motor, please do not hesitate to contact us. We will help you solve your problem from our extensive experience.

Technology to Inspire Innovation

The logo for Japan Aviation Electronics Industry (JAE) features the letters "JAE" in a bold, black, sans-serif font. The letters are centered between two thick, solid blue horizontal bars. The top bar is positioned directly below the tagline "Technology to Inspire Innovation", and the bottom bar is positioned directly below the "JAE" text.

JAE