

高周波誘導加熱 –Induction Heating System–

【加熱原理】

誘導加熱は家庭用IHクッキングヒーターと同じ原理です。高周波誘導はコイルを用いて加熱します。コイルに円柱状の金属を挿入すると表面から加熱されます。この現象は以下になります。

- ①コイルに流れる電流により磁界が発生。(交番磁束)
- ②磁界は金属円柱内にも発生。
- ③金属円柱内にはこの磁界を打ち消す方向にうず電流が流れる。うず電流は表面に近いほど多い。(＝表皮効果)
- ④うず電流と金属の電気抵抗でジュール熱が発生し表面に近いほど発熱が多い。
- ⑤金属円柱は表面から加熱と同時に放熱も生じる。
- ⑥金属円柱の中央部は、表面近くで発生した熱の伝達を受け、表面より少し遅れて加熱。

加熱物の形状、被加熱部分、材質、昇温スピードにより周波数や出力、コイル形状を検討します。

【Heating Principle】

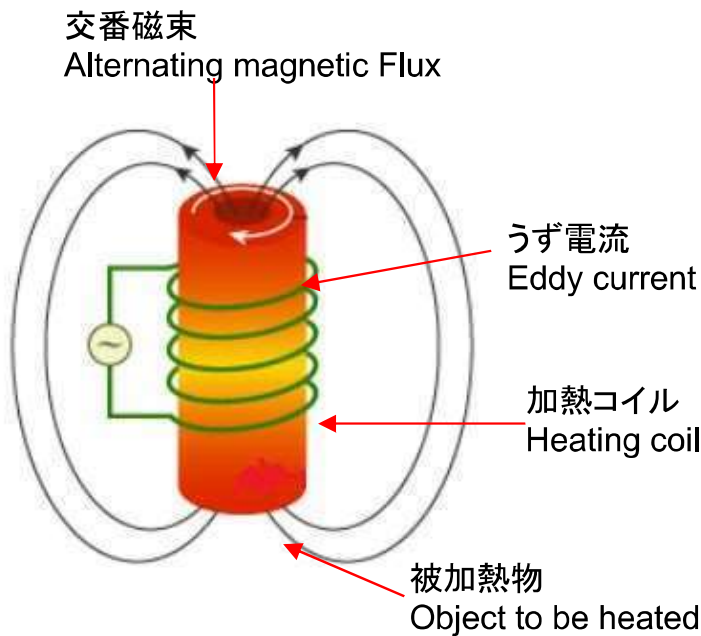
Induction heating has the same heating principles as induction cook tops used at home.

It uses a coil to heat the target object. In the case of the figure, the metal is heated from the surface when a metal cylinder is inserted into the coil connected to an AC power supply.

Let us follow this phenomenon in sequence:

- ① A magnetic field is generated by the current flowing through the coil.
- ② A magnetic field is also created in the metal cylinder.
- ③ Eddy currents flow within the metal cylinder, in the direction which cancels out the magnetic field. The more eddy currents flow, the closer it is to the surface. This phenomenon is called the skin effect.
- ④ Joule heating occurs from the electrical resistance between the eddy currents and metal. The closer it is to the surface, the more heat is generated.
- ⑤ The metal cylinder heats up from the surface; however, the heat starts to dissipate simultaneously.
- ⑥ The core of metal cylinder receives the heat generated near the surface, and it is heated slightly slower than the surface.

Frequency, output, and shape of the coil are determined based on the shape of the heating object, the heating area, the material, and the heating speed.



【図2】高周波誘導加熱の仕組み

【Fig.2】Mechanism of high frequency induction heating

【特徴】

誘導加熱は省エネルギー、クリーンで、加熱の制御が高く自動化や省力化を目的とし、今日迄生産に研究に広く採用されております。

- 直接・急速加熱が出来る
- エネルギー密度が高い
- 制御性が良い(加熱、停止が瞬時に可能、生産性が高い)
- 加熱精度・操作性が良い
- コイル・周波数を検討し加熱範囲の選択とコントロールが可能
(加熱範囲を全体から局部迄選択が可能)
- 雰囲気(真空、高真空、大気、加圧、ガス(窒素、ヘリウム、アルゴン))中でも加熱出来る
- 温度範囲 -196℃～2500℃
- 設備占有面積が小さい

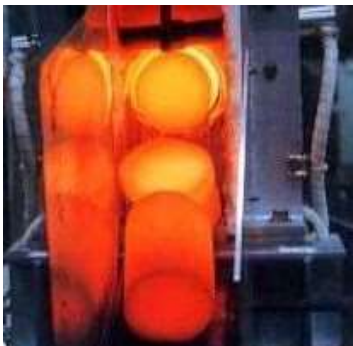
【Features】

Induction heating has been widely used in production and research fields, as an energy-saving device, for the environmentally-friendly electric direct heating, for easy control of heating, and for automation and labor saving.

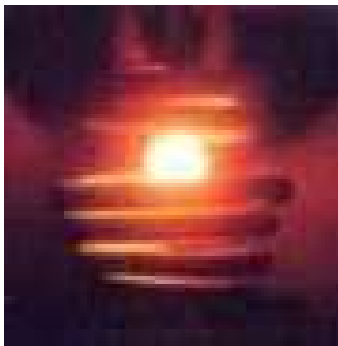
- Direct heating and Rapid heating is possible.
- High energy density.
- High controllability. heating accuracy and operability.
it can be heated and stopped instantly, resulting in high productivity.
- A heating area can be selected and controlled based on the coil and frequency.
The range of heating area can be selected from whole to local.
- It can be heated even in the atmosphere (Vacuum/Gas)
- The equipment has a small footprint.



大気溶解
Air Melting



ビレットヒーター
Billet Heating



浮揚溶解
levitation Melting

【主な市場・目的】

- 目的
金属材料試験
大気溶解、真空溶解、
浮遊溶解、精錬、
保持、焼入、焼鈍、焼戻し、鋳造、
圧延性計、押出、焼ばめ、加熱接着、
粉体塗装、被覆処理、ロー付け
樹脂コーティング、半田付け、他
- 市場
鉄鋼関連、
自動車関連(各種自動車部品)
モーター関連、製管関係、各種工具
大学、各種公的研究機関、他

【Major target markets and objectives】

- Objectives
Metal Material Testing,
Air melting, Vacuum melting,
Floating melting, Levitation melting,
Refining, Holding, Quenching,
Annealing, Tempering, Casting,
Roll ability measuring device, Extrusion,
Joining, Thermal bonding, Powder coating,
Coating treatment, Resin coating,
Brazing, Soldering, etc.
- Target Markets
Steel related
Automotive related (Various automotive parts)
Motor related
Pipe manufacturing related
Various tools
Universities
Various public research institutes, etc.