

## Electric & Induction Heating

### Introduction:

Electric heating is any process in which electrical energy is converted to heat. Common applications include heating of buildings, cooking, and industrial processes. An electric heater is an electrical appliance that converts electrical energy into heat. The heating element inside every electric heater is simply an electrical resistor, and works on the principle of Joule heating: an electric current through a resistor converts electrical energy into heat energy. Alternatively, a heat pump uses an electric motor to drive a refrigeration cycle, drawing heat from a source such as the ground or outside air and directing it into the space to be warmed.

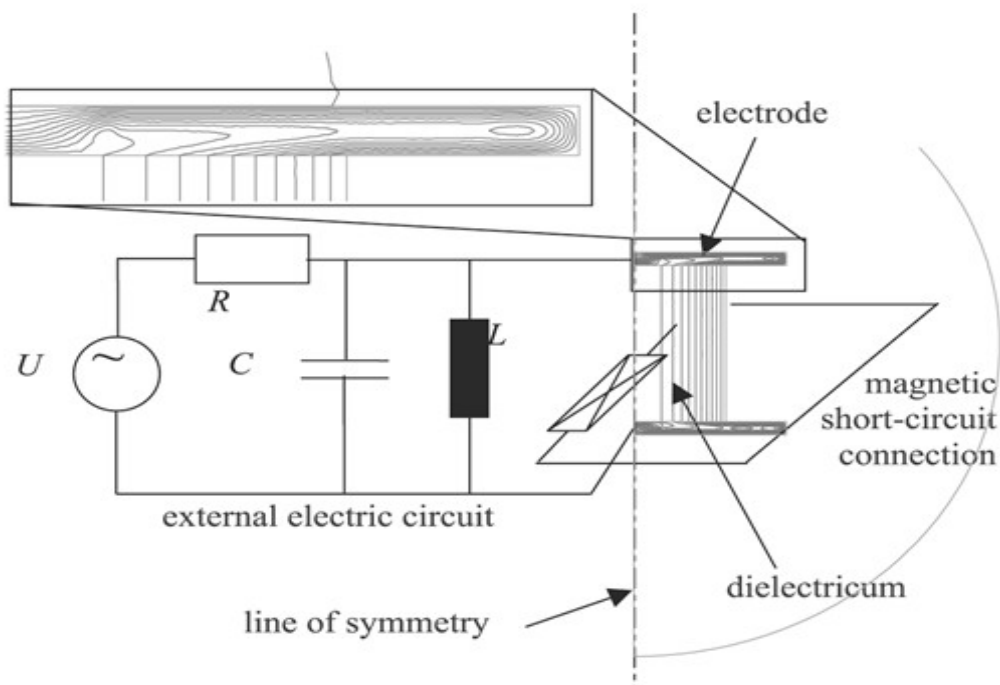
### Definition

Dielectric heating (also known as electronic heating, RF heating, high-frequency heating) is the process in which radiowave or microwave electromagnetic radiation heats a dielectric material. This heating is caused by dipole rotation.

### Power

For dielectric heating the generated power density per volume is calculated by

$$p = \omega \cdot \epsilon_r'' \cdot \epsilon_0 \cdot E^2,$$



Fig(Dielectric heating)

## **Induction heating**

Induction heating is the process of heating an electrically conducting object (usually a metal) by electromagnetic induction, where eddy currents are generated within the metal and resistance leads to Joule heating of the metal. An induction heater (for any process) consists of an electromagnet, through which a high-frequency alternating current (AC) is passed. Heat may also be generated by magnetic hysteresis losses in materials that have significant relative permeability. The frequency of AC used depends on the object size, material type, coupling (between the work coil and the object to be heated) and the penetration depth.

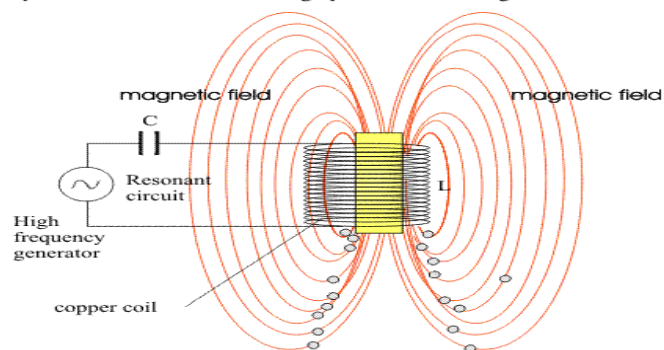
### **Applications of Induction Heating**

- Induction furnace
- Induction welding
- Induction cooking
- Induction brazing
- Induction sealing
- Heating to fit
- Heat treatment

### **Advantages of Induction Heating**

- Optimized Consistency
- Maximized Productivity
- Improved Product Quality
- Extended Fixture Life
- Environmentally Sound
- Reduced Energy Consumption

**Induction Heating**  
Metallic bar placed in the copper coil is rapidly heated to high temperatures by induced currents from the highly concentrated magnetic field.



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