Introduction and microwave chemistry research(2)

1.2 Microwave

Microwave heating means of microwave electromagnetic energy into heat energy. Movement of molecules and material changes related to microscopic particles. Under the action of electromagnetic fields, material microscopic particles can generate four types of dielectric polarization, namely electron polarization (electrons around the nucleus re-arrangement), atomic polarization (re-arrangement of atoms within the molecule), orientation pole of (molecular permanent dipole reorientation) and space charge polarization (free of charge rearrangement). In these four kinds of polarization in comparison with the microwave frequency, the first two polarization is much faster, microwave heating is not generated, and then the two polarization equivalent, can generate the microwave heating, by microscopic particles can this polarization process, the microwave energy into heat energy.

Substances absorb microwave energy available extent dielectric loss tangent to describe, its value is equal to the dielectric constant and dielectric loss factor of the ratio. Dielectric constant and dielectric loss factor is no strict relationship, but the material with microwave energy absorption capacity of the dielectric loss tangent increases. According to the degree of absorption of microwaves can be physical materials into conductors, insulators and media. The main conductor is a metal, such as silver, copper, aluminum, etc., can not enter the microwave conductor, in which only the surface reflection; Insulator means may be transparent to microwave and microwave absorbing little material, such as glass, ceramics, polytetrafluoroethylene and the like; medium may absorb microwaves.

Conventional heating method is the use of an external heat source heat radiation from outside to inside gradually conduction heating, by contrast, microwave heating can be heated simultaneously inside and outside the sample. Although the microwave heating can be directly inside the sample directly into the sample inside the microwave, but into the depth of the interior is not infinite, but finite, this electromagnetic wave into the sample inside the half-power capability commonly penetration depth D1 / 2 (power weakened at tables corresponding to 1/2 of the distance) will be described. D1 / 2 and the microwave wavelength is proportional to the relative permittivity of the sample C. Inversely proportional to the square root.