Processes of Flame during Atomization

In a flame atomizer, a solution of the sample is nebulized by a flow of gaseous oxidant, mixed with a gaseous fuel, and carried into a flame where atomization occurs. The following processes then occur in the flame.

•**Desolvation**: Solvent evaporates to produce a finely divided solid molecular aerosol.

•The aerosol is then **volatilized** to form gaseous molecules.

• **Dissociation** (leads to an atomic gas)

• **Ionization** (to give cations and electrons)

• **Excitation** (giving atomic, ionic, and molecular emission)

These processes can be explained by Sketch Diagram

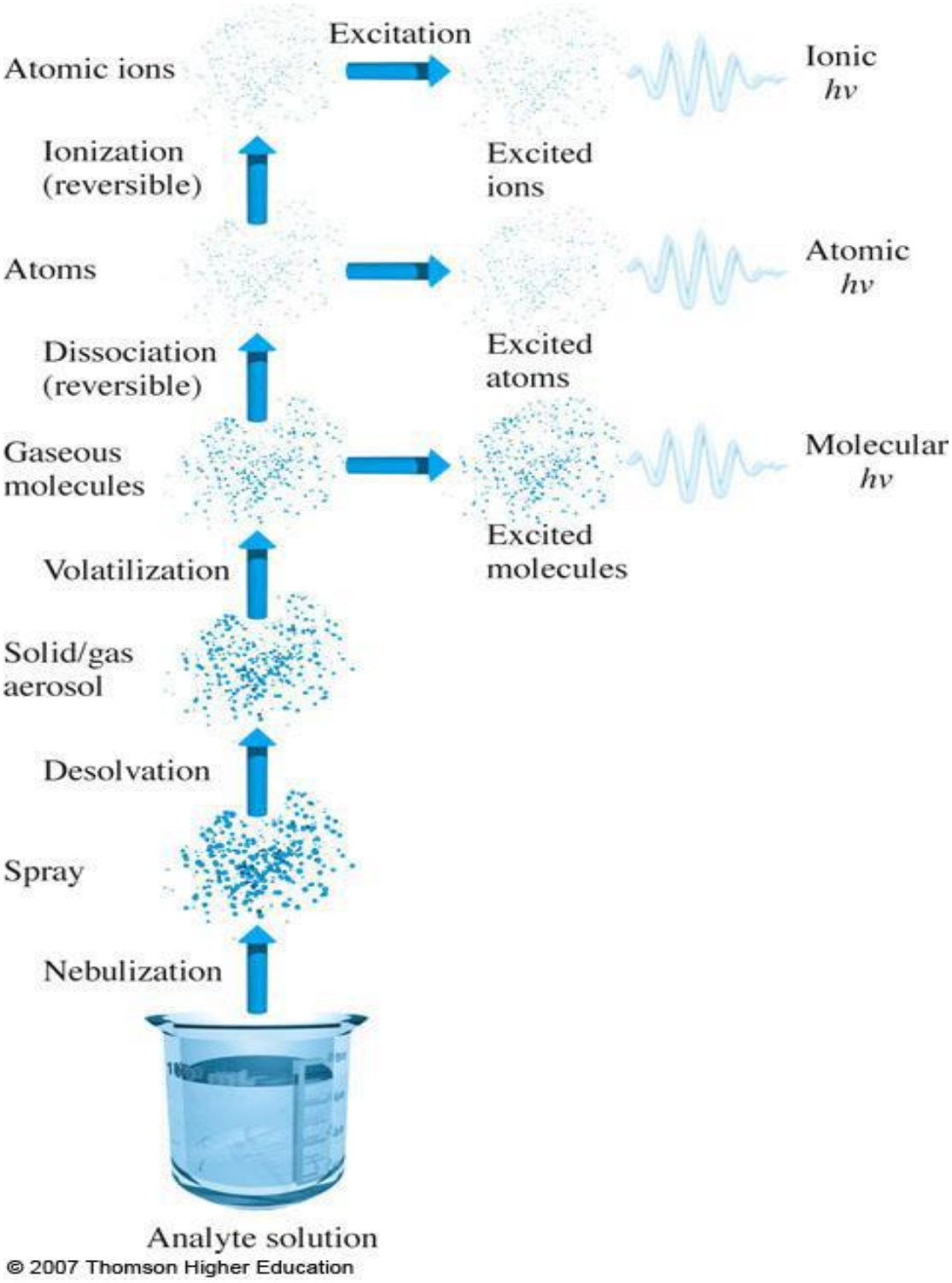

Fig: Processes in Flame

Types of Flames

Temperatures of 1700oC to 2400oC are obtained with the various fuels when air serves as the oxidant. At these temperatures, only easily decomposed samples are atomized.

For more refractory samples, oxygen or nitrous oxide must be employed as the oxidant. With the common fuels these oxidants produce temperatures of 2500oC to 3100oC.

Several common fuels and oxidants can be employed in flame spectroscopy depending on temperature needed

Fuel	Oxidant	Temperature, °C	Maximum Burning Velocity, cm s^{-1}
Natural gas	Air	1700–1900	39–43
Natural gas	Oxygen	2700–2800	370–390
Hydrogen	Air	2000–2100	300–440
Hydrogen	Oxygen	2550–2700	900–1400
Acetylene	Air	2100–2400	158–266
Acetylene	Oxygen	3050–3150	1100–2480
Acetylene	Nitrous oxide	2600–2800	285

Fig: Different types of flames depend on fuel and oxidant

Flame Structure:

Important regions of a flame include:

1.primary combustion zone

2.interzonal region

3.secondary combustion zone

The appearance and relative size of these regions vary considerably with the fuel-to-oxidant ratio as well as with the type of fuel and oxidant.

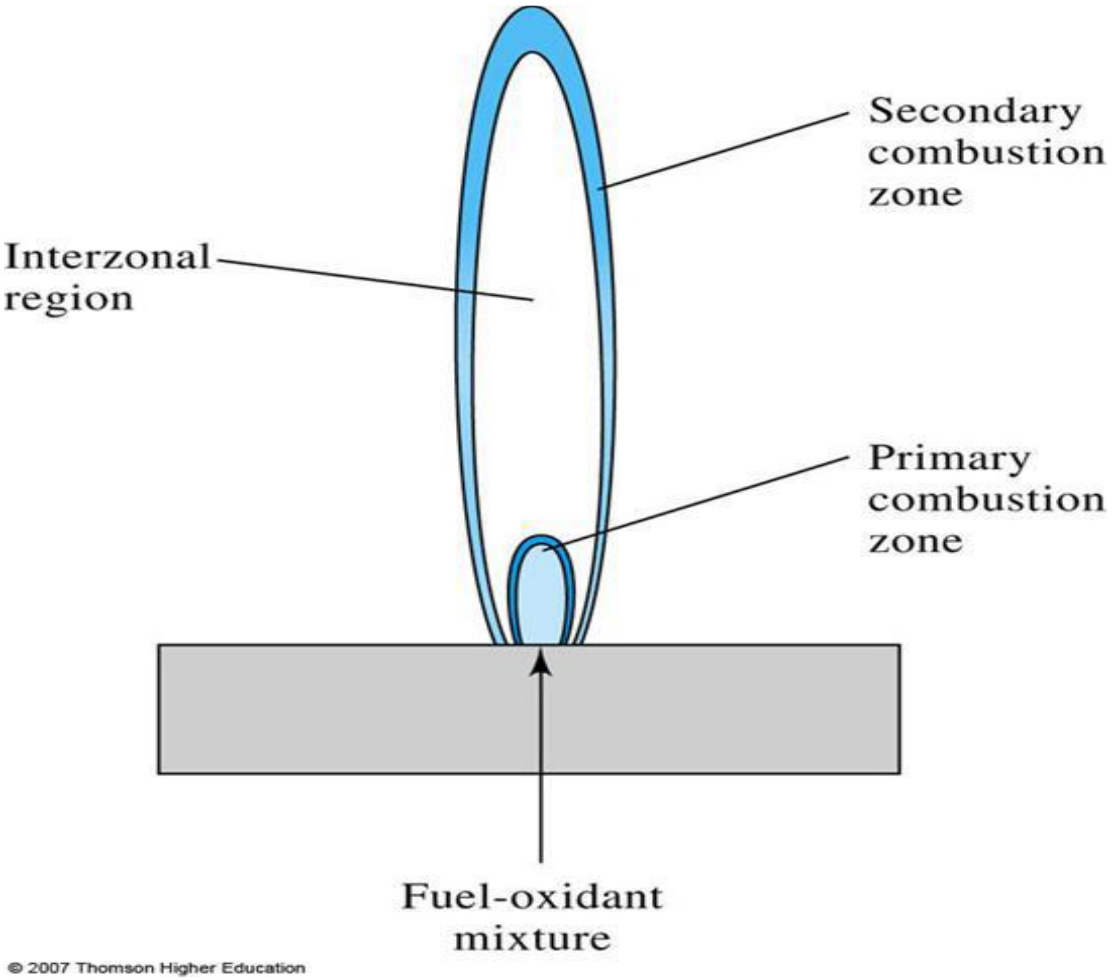

Fig: Flame Structure

1.Primary combustion zone:

Thermal equilibrium is usually not achieved in this region, and it is therefore, rarely used

2. Interzonal region:

Since it is often rich in free atoms, it is the most widely used part of the flame for spectroscopy.

3.Secondary combustion zone:

In the secondary reaction zone, the products of the inner core are converted to stable molecular oxides that are then dispersed into the surroundings.