Ionization Smoke Detectors

Ionization smoke detectors use an ionization chamber and a source of ionizing radiation to detect smoke. This type of smoke detector is more common because it is inexpensive and better at detecting the smaller amounts of smoke produced by flaming fires.

Inside an ionization detector is a small amount (perhaps 1/5000th of a gram) of americium - 241. The radioactive element americium has a half-life of 432 years, and is a good source of alpha particles.

An ionization chamber is very simple. It consists of two plates with a voltage across them, along with a radioactive source of ionizing radiation, like seen in the side picture.

The alpha particles generated by the americium have the following property: They ionize the oxygen and nitrogen atoms of the air in the chamber. To "ionize" means to "knock an electron off of." When you knock an electron off of an atom, you end up with a free electron (with a negative charge) and an atom missing one electron (with a positive charge).

The negative electron is attracted to the plate with a positive voltage, and the positive atom is attracted to the plate with a negative voltage (opposites attract, just like with magnets). The electronics in the smoke detector sense the small amount of electrical current that these electrons and ions moving toward the plates represent.

When smoke enters the ionization chamber, it disrupts this current -- the smoke particles attach to the ions and neutralize them. The smoke detector senses the drop in current between the plates and sets off the horn.

Ionization Smoke Detectors are usually identified by:

The letter " I " -

This Symbol -

or the word " Ionization" - you may also find "americium - 241"