Determination of Density:

Density is the weight of unit volume of the substance, usually expressed in grams/cubic centimeter (g/cm^3).

The determination of density as prescribed in ISO 2781 requires a balance, accurate to 1 mg. For many purposes, however, it is simpler to adopt the flotation procedure using salt solutions of known densities. The method involves finding the solution of known density in which the sample neither sinks to the bottom nor rises to the surface of the solution (i.e. floats inside the liquid). It is very important to remove any air bubbles that may appear at the surface of the sample.

The density of the liquid may be determined by means of an aerometer. Usually, solutions of zinc chloride and calcium chloride are used for this purpose. The approximate density ranges for different elastomer compounds are listed in Table 1 below. However, it should be kept in mind that the amount of fillers can lead to considerable deviations from the figures given in the table. Consequently, density alone is seldom reliable as a means of characterization.

Sulphuric Acid Test:

The sulphuric acid test is one of the most important preliminary tests for differentiation between elastomer types. The method is based on the resistance of different elastomer types to concentrated sulphuric acid at room temperature. Some elastomers deteriorate immediately or after a short time and other types remain almost unchanged.

The test procedure is very simple: place a small piece (about 0.3g, 2mm thick) of unknown sample in a test tube and carefully add to it about 5 ml concentrated sulphuric acid (95-98%, density about 1.84 g/cm^3). If the sample floats on the surface, add small glass rods to keep it at the bottom. Most elastomers float on the surface of concentrated sulphuric acid because they usually have much lower density than 1.84. Normally, FKM, FFKM have higher density than 1.84 and they do not float.

Note whether the sample deteriorates immediately after adding the sulphuric acid. If this is not the case, close the test tube with a cork (sulphuric acid is hygroscopic) and allow it to stand for at least 4 hours, preferably overnight, at room temperature.

At the end of the immersion period, carefully decant the sulphuric acid into a small beaker and remove the sample from the test tube after washing it several times with water. Blot lightly with filter paper and record all changes. Classify the unknown material using Table 2 as a guideline:

Time of Exposure	Kind of Change	Rubber Polymer
Few minutes	Complete deterioration	T, GPO
4 hours	Complete deterioration or dissolution	ACM, CO, ECO, AU, EU, YPBO, VMQ, PVMQ
	Softening, tacky or smeary surface	IIR, BIIR, CIIR, FMQ
	Swelling and softening, unchanged surface	AEM, FZ
	Excessive hardening, cracky or brittle	NBR, SBR, CR, NR
	No visual change	HNBR, EPM, EPDM, CM, CSM, FPM, FFKM

Accelerated Heat Aging at 200^{o}C:

The property changes of an unknown sample after a short exposure to hot circulating air at 200^{o}C can provide useful information that can lead to its identification.

Place a strip of the sample (about 2 mm thickness) in the air oven after it has been preheated to 200^{o}C. Note whether the specimen melts or decomposes after 30 minutes of aging. If this is not the case, continue aging for at least 4 hours. Afterward, remove the specimen from the oven, cool to room temperature on a metal surface and note the changes in the material.

If the changes are minor or not clear, place the specimen again in the oven and prolong the aging test for a further 20 hours. Table 3 shows property changes of different elastomer types after heat aging at 200^{o}C for periods of ½, 4 and 24 hours.

Burn Test:

Natural Rubber:

Burns continuously and becomes sticky and leaves a black patch on the holding portion.

- Burns in the flame and keeps on burning after removal from the flame.
- Yellow-orange flame, crackles a little.
- Black smoke with carbon particles.
- Does not drip.
- Smells of burnt rubber.

EPR:

Ethene Propene Rubber, poly-ethene propene:

- Burns in the flame and keeps on burning after removal from the flame.
- Yellow flame, crackles a little.

- White-grey smoke.
- Drips.
- Burning candles smell.

EPDM:

Burns readily with a sooty flame leaving a dry and waxy odour.

Burning EPDM which has carbon black as a filler, results in a black smoke with carbon particles.

SBR:

- Burns in the flame and keeps on burning after removal from the flame.
- Yellow-orange flame, crackles a little.
- White-grey smoke with carbon particles.
- Does not drip.
- Smells of town gas.

CR:

Burns with a sparkling flame with HCL odour and if tested with Copper (heat the Copper and touch the sample), the flame will glow green.

- Burns in the flame and extinguishes after removal from the flame.
- Yellow-orange flame.
- Black smoke with carbon particles.
- Does not drip.
- Irritating smell.

NBR:

Burns with a sooty flame leaving an intolerable smell.

- Burns in the flame and keeps on burning after removal from the flame.
- Yellow-orange flame, crackling, spark.
- Black smoke.
- Drips.
- Smells of burnt hair.

Silicone:

Burns with a white flame giving white smoke (no other elastomer gives white smoke) smelling like bitter almond.

- Burns in the flame and extinguishes after removal from the flame.

- Bright flame.
- The burnt part glows and is colored white.
- White smoke.
- Does not drip.
- No smell.