Assessment of fire damage structures using NDT techniques

Following techniques use to analyse the fire damage concrete.

- Sampling by core extraction
- Visual observations
- Ultra-Sonic Pulse Velocity
- Chemical analysis
- XRD
- Carbonation
- DTA
- Petrographic analysis

1. Chemical analysis

Chemical analysis of hardened concrete can provide a wealth of information about the mix constituents and possible causes of deterioration. Standard methods can be used to find the cement content and approximately aggregate cement ratio, but many other properties can also be established.

Chloride content can be determined from broken samples or core samples of concrete. Primarily the level of chloride near the steel-concrete interface is of prime importance. Chloride present in concrete are fixed (water insoluble) as well as free (water soluble). Though it is the water-soluble chloride ions, which are important from corrosion risk point of view, yet total acid soluble (fixed as well as free) chloride contents are determined and compared with limiting values specified for the concrete to assess the risk of corrosion in concrete.

2. Ultra-Sonic Pulse Velocity

- The ultrasonic pulse velocity method is used to establish.
- The homogeneity of concrete.
- The presence of voids, cracks and other imperfections.
- Changes in structure of concrete which may occur with the time.
- The mass integrity of the concrete in relation to standard requirement.
- The mass integrity of one element of concrete in relation to the other.

The ultrasonic pulse is generated by an electro acoustical transducer. When the pulse is transmitted through the concrete, it undergoes multiple reflections at the boundaries of the different material phases within the concrete. A complex system of stress waves is developed which includes longitudinal shear and surface waves. The receiving transducer detects the onset of the longitudinal waves, which is the fastest. The velocity of the pulses is almost independent of the geometry of the material

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through which they pass and depends only on its elastic properties. Ultrasonic pulse velocity is a very desirable technique for investigating structural concrete in the field. Pulse velocity method is a convenient technique for investigating structural concrete. Comparatively higher velocities are obtained when the quality of concrete in terms of density, homogeneity and uniformity is good. If there is crack, void or flaw inside the concrete which comes in the way of transmission of the pulses, the pulse strength is attenuated, and it passes around the discontinuity thereby making the path length longer and lower velocities are obtained. The UPV method involves measuring the travel time over a known path length of pulse.

3. XRD

X-ray diffraction (XRD) technique has been used in several works to characterize cementitious materials. XRD pattern allows the study of cement hydration products at different curing ages and with different materials additions by analysing peak positions and relative pattern intensities.

4. Petrographic examination

Concrete petrography can help answer many basic questions about hardened concrete. This includes identifying its constituent aggregates, estimating the approximate apparent water to cement (w/c) ratio of the paste, determining the types of pozzolanic material in the paste, presence of deleterious materials, depth of carbonation of the paste, and approximate amounts, types, and distribution of air void quality of cement paste and paste aggregate bond, presence of micro cracks, alkali silica reaction, interfacial transition zone between aggregate and cement paste, decomposition of cement aggregate bond etc.

The equipment's generally used for specimen preparation are diamond saw, , free abrasive machine, polishing wheel plate-glass squares, suitable media, and microscope slides. For specimen examination, the equipment needed are stereomicroscope, dollies, petrographic or polarizing microscope.

5. DTA / TGA

A TG/DTA measures the change in sample weight as a function of temperature (and/or time) under controlled gas atmosphere and temperature. Graphing the percent weight change over a programmed temperature range enables the study of physical or chemical processes that have caused the sample to lose or gain weight.

It is possible to estimate the temperature seen by the concrete during fire.

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PHOTO GALLERY

Figure 1 Fire Damaged Structure

Figure 2 Fire Damaged Structure

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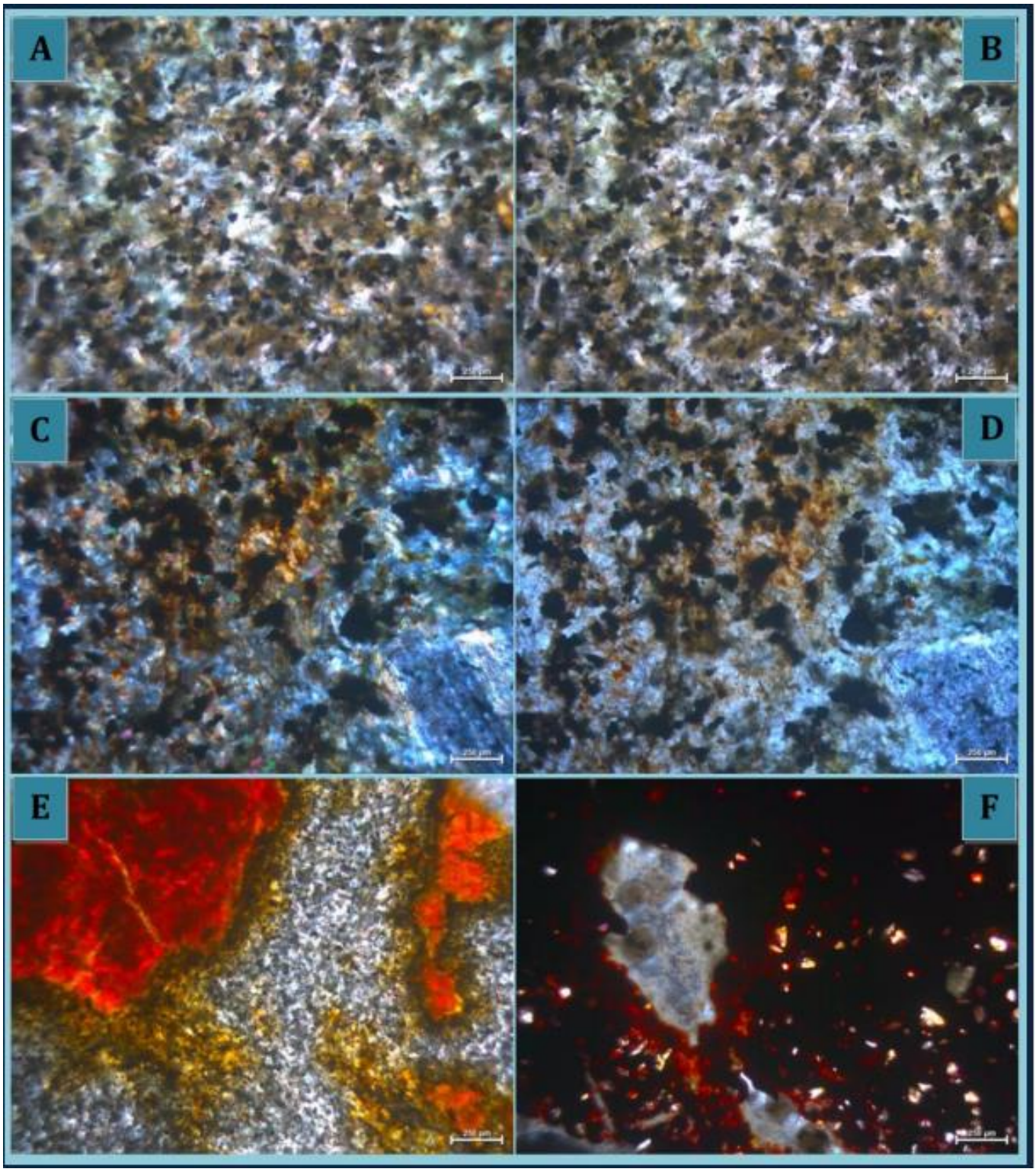

Figure 3 Petrography of Concrete

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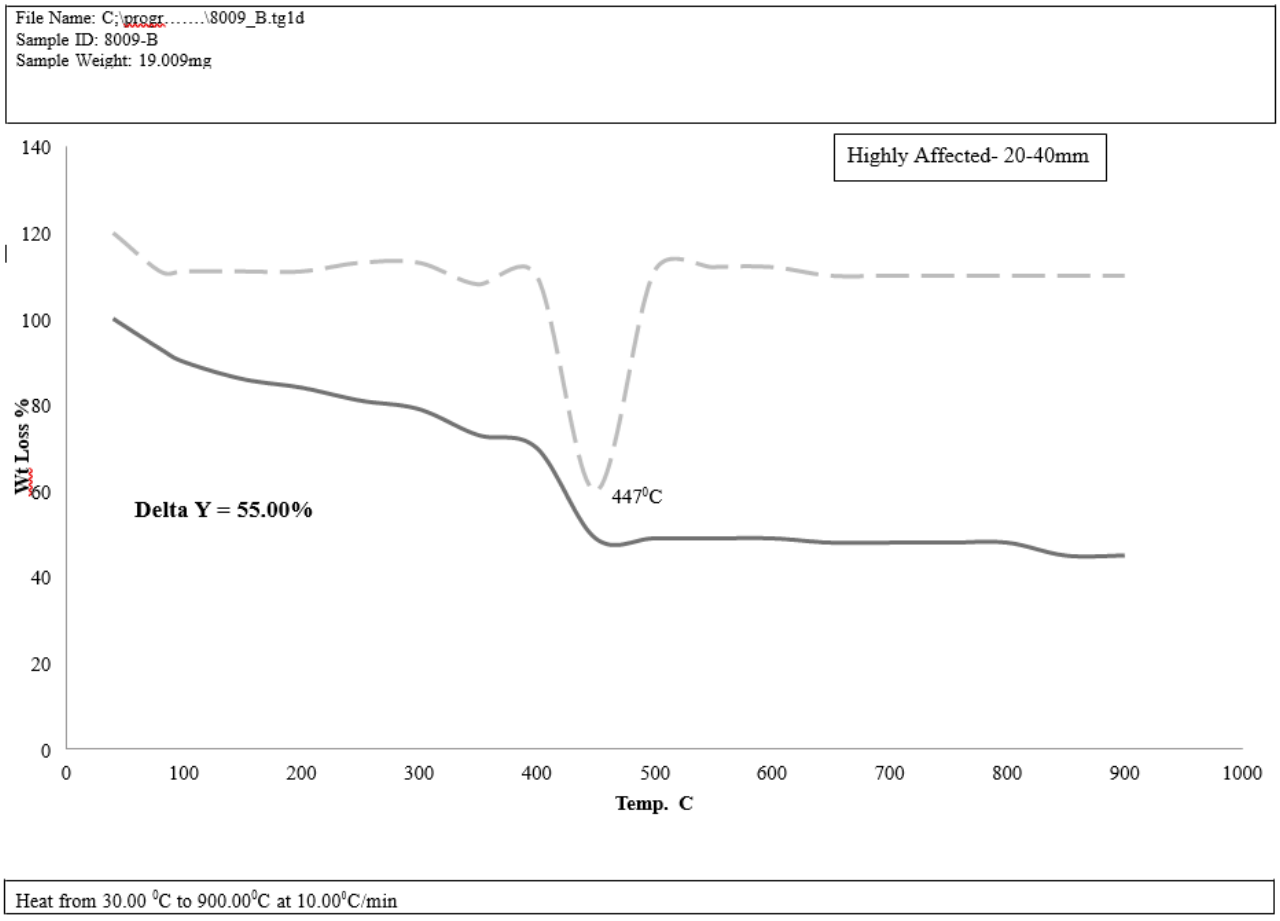

Figure 4 TGA Graph

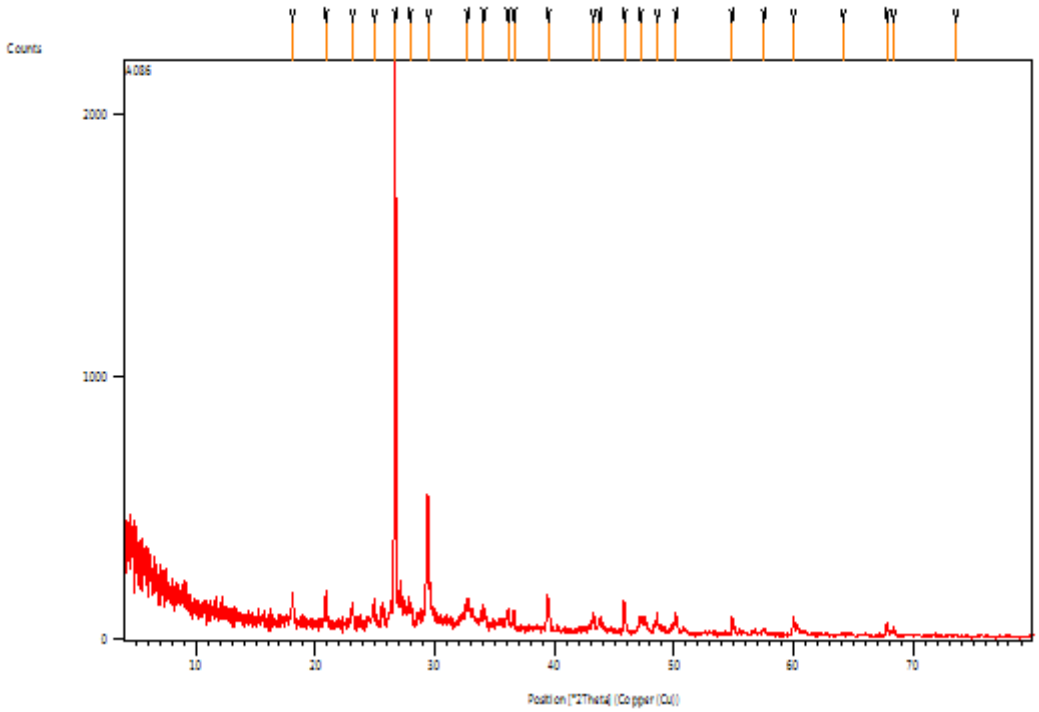

Figure 5 XRD Graph

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