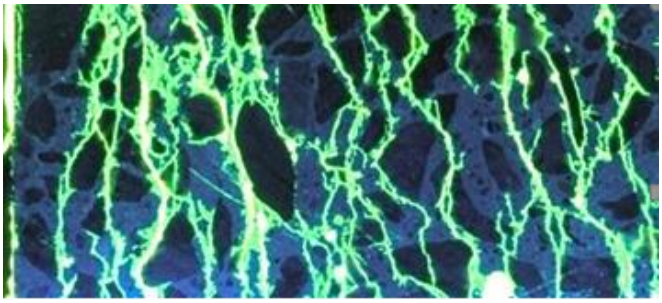
NDTitans in action

Case 14.1 Petrography, examples of micro- and macro analysis

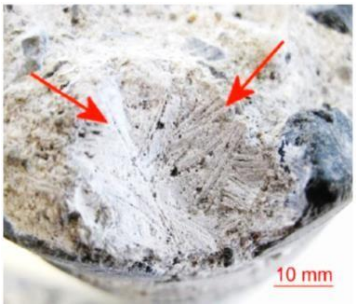
Petrography

For a trained petrographer this technique is powerful to understand details in concrete composition and deterioration mechanisms. Although not a strictly non-destructive test, petrography can contribute valuably to problematic assessments following NDT. Good petrographers are trained geologists, chemists or engineers who are also excellent in detection of chemical attacks from deleterious ions such as sulphates.

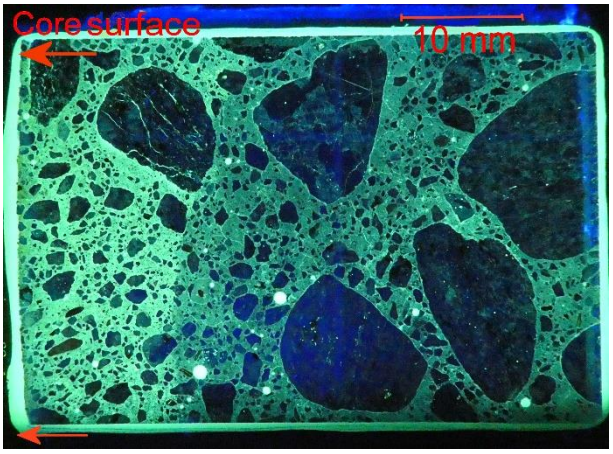
Petrography covers macro description of cores/plane sections, and microscopic analysis on thin sections after polarization and fluorescence microscopy, see examples below. SEM/EDX analysis can contribute to more details, if needed.



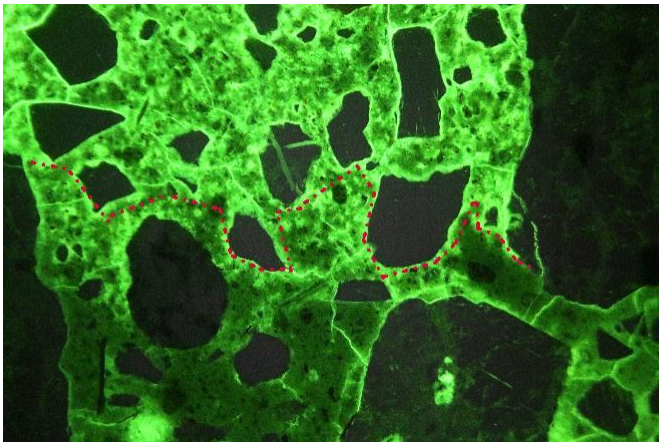
1. Plane section, cut through an epoxy impregnated core (with a fluorescent dye added). Severe cracking by alkali silica reactions, with cracks forming parallel to the surface. Length ~300 mm.



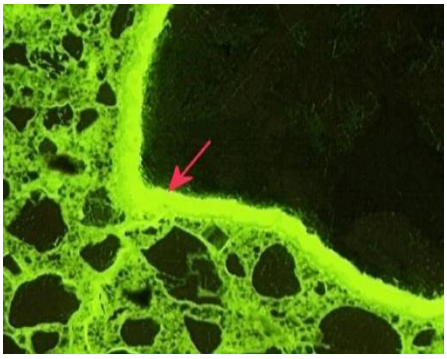
2. Ice flowers formed between aggregates and cement paste before hardening of the concrete (sign of early frost exposure).



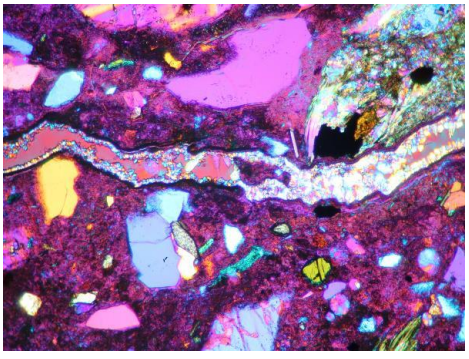
3. Thin section, 30 mm x 45 mm. Seawater exposed surface to the left. Leaching is seen near the surface, in the outermost 20 mm. Border between leached and intact concrete, see photo 4.



4. Thin section, 1 mm x 1.5 mm, surface placed upwards. The cement paste to a depth about 20 mm has been leached (light green colour) and has lost strength due to higher porosity caused by the leaching.



5. Thin section, 1 mm x 1.5 mm, from concrete suffering from DEF, Delayed Ettringite Formation. Severe internal expansion may occur if the concrete had high temperature at casting/early curing. This can happen years after casting when moisture becomes available.



6. Thin section, 1.8 mm x 2.4 mm. Surface parallel crack near surface in seawater exposed concrete. Deposits from reactions between seawater and cement paste are found in the crack and the paste (such as ettingite, gypsum, and thaumasite).

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