

Purpose

PetroThin is the ultimate thin section preparation machine.

Principle

Thin sections are used extensively by petrographers to study the microstructure of concrete. As discussed in ASTM C856, "Standard Practice for Petrographic Examination of Hardened Concrete," examination of thin sections of concrete and related materials is one of the most powerful methods for determining and characterizing the following features:

- The water-cement (w/c) ratio
- The cement type, degree of hydration, and dispersion of cement particles
- The type of pozzolan, degree of hydration, and cement-pozzolan ratio
- Mixture proportions
- Aggregate type, gradation, and quality
- Crack measurement and characterization
- Air-void structure
- Surface structure and finishing defects
- Alkali silica reaction (ASR)
- Alkali carbonate reaction (ACR)
- Delayed ettringite formation (DEF)
- Freezing and thawing damage
- Freezing of fresh concrete
- Bleeding characteristics
- Depth of carbonation
- Deleterious aggregates



1. Rough cut sample
2. Polished block
3. 20 μm thick polished section

Examination of a thin section is an extremely powerful and versatile tool for quality assurance and development of new types of concrete, admixtures, fibers, or alternative raw materials. In forensic examination of deteriorated or damaged concrete, fluorescent thin section analysis is the fastest and the most reliable tool for describing and determining causes of deterioration or damage.



The **PetroThin** is a compact machine that can be fitted easily into an existing laboratory



Grinding roller and massive sample holder in operation

PetroThin

The standard fluorescent epoxy impregnated thin section for transmitted light microscopy is only 20 μm thick. The process involved in preparing the 20 μm thick slice of fluorescent epoxy impregnated concrete is extremely difficult using ordinary lapping equipment.

PetroThin is the only machine in the world that can perform the required type of grinding on an inexpensive, rapid, and routine basis. The grinding guides on **PetroThin** use the surface of the glass slide as a reference for grinding. Thus, it is possible to prepare 20 μm thick slices quickly and accurately.

The **PetroThin** has 30 years of proven track record with excellent results.

The machine is easy and safe to operate. The training needed to operate the equipment and prepare thin sections in a consistent manner can be accomplished within one week.

The standard thin sections produced on the **PetroThin** are 30 mm \times 40 mm, but it is also possible to produce larger 30 mm \times 70 mm thin sections.

The **PetroThin** comes with a built-in diamond saw and a grinding unit.

Procedure

The basic steps in the preparation of thin sections on the **PetroThin** are as follows:

- 1 A 30 mm \times 40 mm \times 20 mm block of concrete is cut out of the sample (see previous page).
- 2 The block is bonded to a 30 mm \times 40 mm piece of glass and it is trimmed on the diamond saw to a thickness of 10 mm.
- 3 The block is mounted on the **PetroThin** and ground by the three successively finer diamond grinding rollers.
- 4 The block is vacuum impregnated with fluorescent epoxy. When the epoxy has cured, excessive epoxy is ground off plus 7 μm into the material.
- 5 The block is glued by a UV-hardening adhesive to the final glass slide and excess material is cut off with the diamond saw.
- 6 The glass slide is mounted on the traveling head of the **PetroThin**, and the material is ground down to a thickness of 20 μm using three successively finer diamond grinding rollers. The thickness is controlled by checking the birefringence colors of quartz or feldspar particles using a polarizing microscope or by direct measurement with a caliper.
- 7 Eventually, a cover glass is glued to the polished surface of the thin section. Alternatively, the specimen is polished if it will be used for scanning electron microscopy (SEM) or microprobe analysis.

Requirements

The **PetroThin** is simple to install in a laboratory or other suitable area. The **PetroThin** requires access to 380 VAC, cold water, and a vacuum source. Additionally, it is desirable to have access to a fume hood, drying oven, equipment for vacuum impregnation of the samples, and a rugged diamond saw for rough cutting of larger samples. **Germann Instruments** can provide all the necessary supporting equipment.

Germann Instruments will provide assistance in setting up the equipment and training technicians. Additionally, we will provide courses in concrete petrography, optical microscopy, and SEM/Microprobe analysis.