MICROSCOPIC OBSERVATION OF CRYSTAL GROWTH AND PHASE TRANSITIONS

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Easy handling, fascinating color pictures and the feeling of a microscopic insight to the shaping of crystals are the main characteristics of demonstrations with a heating table. If a common microscope is available, best in connection with a photographic and video adapter, the following further components are neccessary: a heating table (see educational companies), a power supply, two polaroids and some chemicals (see below).

However, it proved advisable to use a sensitive temperature control for the heating table. On this behalf, a device for temperature control was developed and used for some measurements of transition temperatures. It proved to be an important tool for qualitative and reproducible demonstrations (see below).

Possible demonstrations are:

- Comparison of the **size of the crystallites of naphtalene** grown at various cooling rates.
- Comparison of **clean naphtalene and a mixture** (some percent organic colorant added): It can be shown that the solidification of a mixture with different structures leads to a separation (clean naphtalene and enriched mixture with colorant, as obtained by zone refining; see also poster "Demonstrations on Zone Refining").
- **Birefringence in liquid crystals** (type MBBA, m-butyl-benzene, nematic): Arrangements of black and colored areas show up. Within each domain the elongated molecules of MBBA arrange themselves in parallel in different directions. In the dark areas this arrangement is parallel with one of the polaroids. In the single spots, where branches of different colors meet (called "disinclinations"), various orientations coexist. These spots play the role of crystallizing nuclei.
- **Crystallisation in a strongly supercooled melt** of salole, induced by adding a nucleus for crystallisation: The crystallites grow in the direction of the temperature gradient.
- **Melting and growing of a single salole crystal** by subsequent heating and cooling: While heated, the crystal starts to melt at certain places. When cooled, the molten parts recrystallize very fast and thus restore the original shape.

Photografic data
Magnification of microscope: 40 times
Film: 100 ASA and 1000 ASA, (Exposure time: 0,5s to 5s).

Reference

- Chernov, Alex. A.: Modern Crystallography, Solid-State-Sciences, Springer, Vol II p. 204 ff, vol IV p. 513 ff.
- Keller, E.: Wachstum und Aufbau der Kristalle, Praxis-Schriftenreihe, Abt. Physik, Bd. 10, Aulis Verlag.