

Relation of Light-Transmittance and Defects in Optical CaF₂ Single Crystal

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Calcium fluoride(CaF₂) single crystal is very useful for optical applications ; laser optics, high-quality micro and macroscopic fields, refractive astronomical telescope lens and HD-TV camera lens, and so on. It has superior characters which are low refractive index(1.432 @656.27nm), low light-dispersion, high transmittance and wide light-transmittance.

Calcium fluoride has been grown by the Stockbarger-Bridgman method used for metal halide single crystals. In this study, the CaF₂ crystal was grown by non-seed technique. In the grown CaF₂ crystal, however, the internal defects were discovered. Forms of the internal defects are some kinds of color center related point defect, scatter as a called negative crystal and bubble, and the like. So we are going to analyze of these defects.

The preparation process of specimens for analytical experiments is as followed.

The first, general & colored crystal ingot were selected, the second, the wanted position in each ingots cutted, and the third, the sliced blanks polished by final treatment to 1 μ m slurry. With the final polished specimen, we are tried to examine into the internal defects using UV-Vis-IR spectroscopic analysis, composition analysis and microscopic analysis.

The aims of this study are as followed.

- 1 Comparison of transmittance and absorption in the range of UV-Vis-IR light to violet color, spread-scatter and bubble in CaF₂ crystal
- 2 Presentation of defects in CaF₂ crystal by spectroscopic analysis
- 3 Discussion about relation of optical properties and internal defects (variation of composition, etch pit density(EPD), scatter & bubble, etc.)

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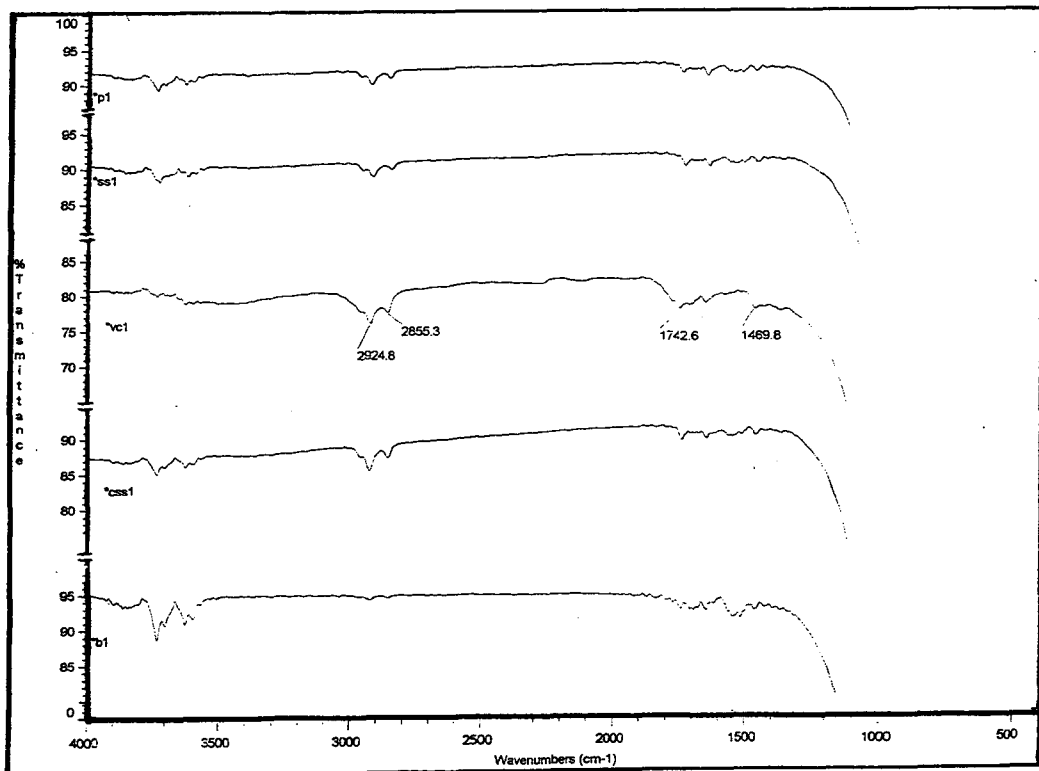


Figure 1. IR spectrums of violet colored & general specimens.

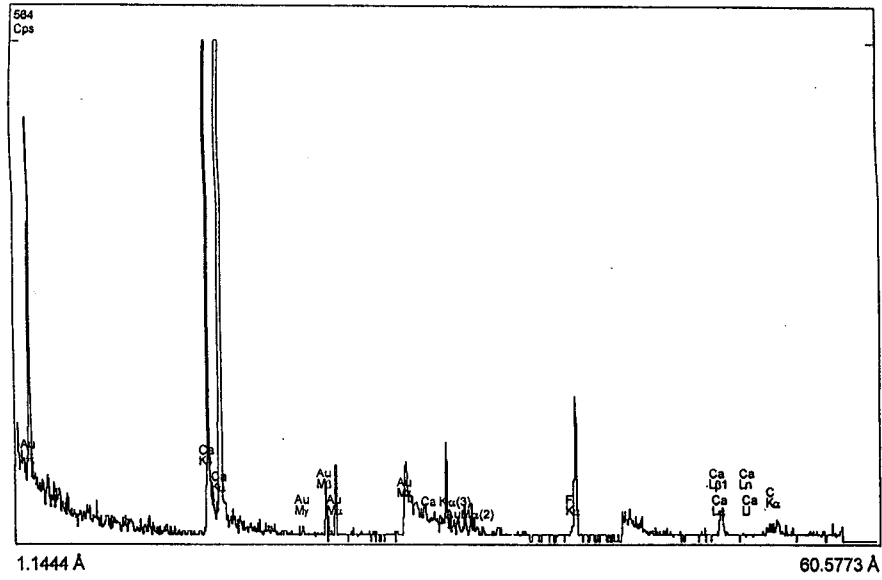


Figure 2. Composition analysis of CaF₂ polished crystal using WDX.

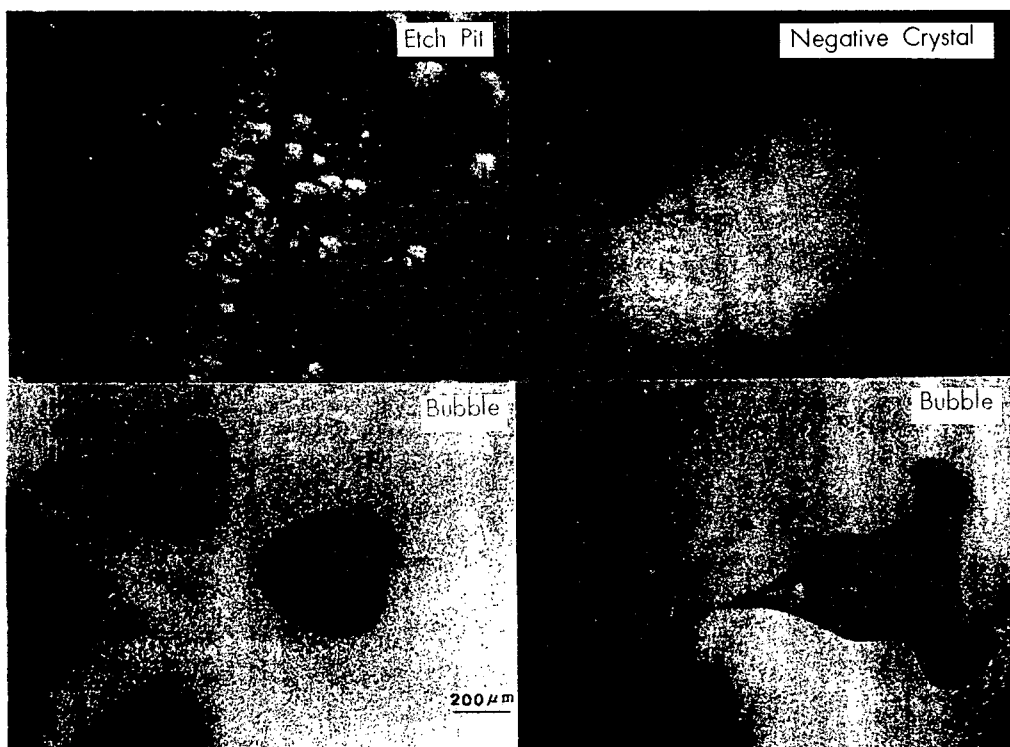


Figure 3. Photographs of etch pit, negative crystal & bubble.