

Differential laser-interferometer for thermal expansion measurements

KOJI MASUDA,^{1,*} DAVE ERSKINE,² AND ORSON L. ANDERSON³

¹Geological Survey of Japan, Tsukuba 305-8567, Japan

²Lawrence Livermore National Laboratory, Livermore, California 94551, U.S.A.

³University of California, Los Angeles, Los Angeles, California 90095, U.S.A.

ABSTRACT

The differential laser interferometry method and its application for measuring the thermal expansion of samples is described. The thermal expansion of single-crystal Al₂O₃ (corundum) was measured up to 1000 K with the differential laser-interferometer. The changes in the distance between two faces of a stepped shape sample are measured. The main feature of the apparatus is simultaneously monitoring two fringe signals that are 90° out of phase. This improvement of the basic laser-interferometer allows us to remotely measure the thermal expansion of minerals with high precision. The overall sensitivity with which we can detect changes in length is about 1/100 of the wavelength of the He-Ne laser (1/100 of 0.6328×10^{-6} m). After adjusting for errors caused by heat, the thermal expansion data measured with the differential laser-interferometer are in good agreement with previous reports. Use of this apparatus allows the investigation of the high-temperature thermodynamic properties of important rock-forming minerals.