*American Mineralogist, Volume 92, pages 1573–1585, 2007*

# The albite fusion curve re-examined: New experiments and the high-pressure density and compressibility of high albite and $NaAlSi_3O_8$ liquid

**Travis J. Tenner,[1,*] Rebecca A. Lange,[1] and Robert T. Downs[2]**

[1]Department of Geological Sciences, University of Michigan, 1100 N. University Avenue, Ann Arbor, Michigan 48109-1005, U.S.A.
[2]Department of Geosciences, University of Arizona, Tucson, Arizona 85721, U.S.A.

## Abstract

Experimental brackets on the melting temperature of high albite ($NaAlSi_3O_8$) were determined at 2.33 ± 0.03 GPa (1360–1370 °C) and 2.79 ± 0.03 GPa (1370–1389 °C) in a piston-cylinder apparatus. All run products that quenched to a glass were analyzed by Fourier-transform infrared spectroscopy and found to contain ≤500 ppm $H_2O$. In addition, new X-ray diffraction experiments on fully disordered albite are reported to 7.6 GPa; the fitted results lead to a zero-pressure bulk modulus ($K_0$) of 56.4 ± 0.7 and a pressure derivative ($K_0'$) of 3.9 ± 0.3 in a third-order Birch-Murnaghan equation of state. Revised values for the enthalpy and entropy of fusion of high albite at one bar and 1100 °C [$\Delta H_{T_f}$ = 64.5 ± 2.1 kJ/mol and $\Delta S_{T_f}$ = 47.0 J/(mol·K)] are recommended on the basis of improved heat capacity equations for $NaAlSi_3O_8$ glass and liquid. On the basis of these new results on the fusion curve and thermodynamic data for high albite, the pressure dependence of the $NaAlSi_3O_8$ liquid compressibility ($K_0'$) is constrained to be 10.8 ± 1.5 in a third-order Birch-Murnaghan equation of state. The uncertainty in $K_0'$ of ±1.5 contributes an error to melt density at 3 GPa (2.543 ± 0.010 g/cm$^3$ at 1500 °C) of ±0.4%.

**Keywords:** Compressibility measurements, albite, high-pressure studies, high-temperature studies, phase equilibria, thermodynamics