thin crust and raise the solid surface of the CNI into a lithospheric dome. Andesite and rhyolite volcanism have been present in the CNI for the past 4-5 my. Mudstone porosity analyses to the west and south of the volcanic region shows that over 2 km of exhumation has occurred in CNI since 4 Ma. This combined with a coeval surface uplift of $\sim$ 500 m, indicates a maximum 2.5 km of rock uplift. Marine terraces 100-150 km from the centre of maximum exhumation show uplift rates of $\sim$ 0.2-0.3 mm/y consistent with about 1 km of exhumation if averaged over 4 my, which compares well with the mudstone porosity results. The magnitude and wavelength ($\sim$ 400 km) of the uplift is similar to that observed in continental areas associated with mantle upwelling (e.g. Yellowstone). Explosion seismic studies show an arched Moho, crust that has been thinned to nearly half its original thickness and Pn wave-speeds 8% lower than normal. Seismic attenuation (Q) studies show strong attenuation throughout the mantle wedge below CNI. Isostatic modelling is used to explore processes consistent with these observations. The observed rock uplift pattern may be explained by the replacement of about 70 km of mantle lid with asthenosphere of density contrast $\sim$ 100 kg/m^3 with respect to normal mantle. Such a density contrast cannot be explained by temperature change alone, and a partial melt of up to 5% is implied. Strong seismic reflections from within a confined zone of the mantle wedge were recorded. These reflections from $\sim$ 35 km deep show strong amplitudes in an incident angle range consistent with the AVO response of a body with a high degree of fluid or melt.

V41A-08 0945h

Transient Dilatancy in the Transport of Magma and Flareup Magmatic Events

Scott E. Johnson[1] ((207) 581-2142; johnsons@maine.edu)

Peter O Koons[1] ((207) 581-2158; peter.koons@maine.edu)

Phaedra Upton[1] ((207) 581-2221; phaedra.upton@maine.edu)

[1]University of Maine, Department of Earth Sciences, Orono, ME 04469, United States

Migmatite belts around the world show features that have led workers to conclude that melts move into strain heterogeneities such as boudin necks and shear zones. The inference generally made is that these are transient sites of relatively low pressure. In the Main Martir Thrust zone of the Peninsular Ranges batholith, synkinematic migmatites formed in a kinematically well-constrained setting. Melt layers on the thrust zone occupy shear bands and are connected across short jogs at a high angle to the thrust-zone boundaries. This geometry is analogous to dilatant jogs that form between interacting brittle cracks. The formation of these features at elevated T suggests that elevated strain rates, elevated magma pressures, or both played an important role in embrittlement. Magmatic arcs are commonly long-lived, but their construction is apparently dominated by a limited number of transient magmatic events. In the Peninsular Ranges batholith, approximately 50% of the exposed arc was emplaced between 99 and 92 Ma, leading to production rates on the order of 75-100 km*3/km/m.y. Several different explanations have been proposed for such transient flareup events, and here we explore, in 3-D, the implications of crustal-scale dilatancy to magma formation and transport processes during lithospheric subduction, using the North Island of New Zealand as a modern analog.

V41B MCC: 3008 Thursday 0800h

Frontiers in High-Pressure Research: New Opportunities I *(joint with GP, MR, DI)*

Presiding: **A B Belonoshko,** Royal Institute of Technology**; Y Zhao,** Las Alamos National Laboratory

V41B-01 0800h INVITED

Scientific Advancements and Technological Developments of High P-T Neutron Diffraction at LANSCE, Los Alamos

Yusheng Zhao[1] (505-667-3886; yzhao@lanl.gov)

Luke L Daemen[1] (505-667-9695; lld@lanl.gov)

Jianzhong Zhang[1] (505-665-2112; jzhang@lanl.gov)

[1]Los Alamos National Laboratory, LANSCE-12, MS-805 Los Alamos National Laboratory, Los Alamos, NM 87545, United States

In-situ high P-T neutron diffraction experiments provide unique opportunities to study the crystal structure, hydrogen bonding, magnetism, and thermal parameters of light elements (eg. H, Li, B) and heavy elements (eg. Ta, U, Pu,), that are virtually impossible to determine with x-ray diffraction techniques. For example, thermoelasticity and Debye-Waller factor as function of pressure and temperature can be derived using in-situ high P-T neutron diffraction techniques. These applications can also be extended to a much broader spectrum of scientific problems. For instance, puzzles in Earth science such as the carbon cycle and the role of hydrous minerals for water exchange between lithosphere and biosphere can be directly addressed. Moreover, by introducing in-situ shear, texture of metals and minerals accompanied with phase transitions at high P-T conditions can also be studied by high P-T neutron diffraction. We have successfully conducted high P-T neutron diffraction experiments at LANSCE and achieved simultaneous high pressures and temperatures of 10 GPa and 1500 K. With an average 3-6 hours of data collection, the diffraction data are of sufficiently high quality for the determination of structural parameters and thermal vibrations. We have studied hydrous mineral (MgOD), perovskite (K.15,Na.85)MgF3, clathrate hydrates (CH4-, CO2-, and H2-), metals (Mo, Al, Zr), and amorphous materials (carbon black, BMG). The aim of our research is to accurately map bond lengths, bond angles, neighboring atomic environments, and phase stability in P-T-X space. Studies based on high-pressure neutron diffraction are important for multi-disciplinary science and we welcome researchers from all fields to use this advanced technique. We have developed a 500-ton toroidal press, TAP-98, to conduct simultaneous high P-T neutron diffraction experiments inside of HIPPO (High-Pressure and Preferred-Orientation diffractometer). We have also developed a large gem-crystal anvil cell, ZAP-01, to conduct neutron diffraction experiments at high-P and low-T. The ZAP cell can be used for integrated experimental techniques of neutron diffraction, laser spectroscopy, and ultrasonic interferometery. We are conducting further developments of high P-T technology with a new 2000-ton press, TAPLUS-2000, and a ZIA anvil package to achieve of pressure of 30 GPa and temperatures of 3000 K. The new design of a dedicated high pressure neutron beamline, LAPTRON, is also underway for simultaneous high P-T neutron diffraction, radiography, and tomography studies. We seek strong community support for this new development.

V41B-02 0815h

X-Ray Microdiffraction at Megabar Pressures

Ho-kwang Mao (1-202-478-8960; mao@gl.ciw.edu)

Geophysical Laboratory, Carnegie Institution, 5251 Broad Branch Road, NW, Washington, DC 20015, United States

High-pressure x-ray diffraction (XRD) provides unique, important sources of structural information of minerals in the Earth's deep interior, but encounters major limitations. The restriction to forward diffraction geometry (2θ less than 90°) severely limits the accuracy. With the 50-5 μm size x-ray beam typically used to probe samples at 30-200 GPa, the number of crystals covered by the x-ray beam is often too few for good polycrystalline XRD, but too numerous for single-crystal XRD. Single-crystal XRD method with monochromatic x-ray source and 2-d detector works satisfactorily for crystal size larger than 20 μm, but when the crystal is significantly less than 5 μm, the sample signals are often overwhelmed by the background. Energy dispersive XRD with polychromatic x-radiation has been used successfully to determine unit-cell parameters of smaller single crystals, but the intensity information is unusable for structural refinement because this method requires rotation of the small crystal relative to the small x-ray beam. Recent integration of panoramic diamond anvil cell[1] (PDAC) with synchrotron x-ray microdiffraction[2] (XRMD) method has finally overcome these limitations and can potentially revolutionize the high-pressure XRD field. This XRMD method focuses polychromatic x-radiation to submicrometer size to resolve very small single crystals, and collects Laue spots with a 2-d CCD detector. The PDAC allows complete forward, 90°, and back scatterings, while the background signal is minimized by directing the incident x-ray beam through single-crystal diamonds (i.e., avoiding the beryllium seats and gasket). The incident beam can be changed to monochromatic, tuned through the full energy (wavelength) range, and focused to the identical submicrometer spot for d-spacing determination of each Laue spot. All polychromatic Laue spots are collected simultaneously from the same x-ray sampled volume, thus reliable for structure determination. The development provide long-sought solutions to important technical and scientific issues, including the fundamental changes of silicates, oxides, ices, and condensed gases that are the main components of deep planetary interiors. [1] H. K. Mao, J. Xu, V. V. Struzhkin, et al., Science 292, 914 (2001). [2] N. Tamura, R. S. Celestre, A. A. MacDowell, et al., Rev. Sci. Instrum. 73, 1369 (2002).

V41B-03 0830h

High-pressure and High-temperature Studies With Nuclear Resonant Scattering

Wolfgang Sturhahn[1] (1-630-252-0163; sturhahn@anl.gov); Jung-Fu Lin[2]; Jiyong Zhao[1]; Guoyin Shen[3]; Vitali Prakapenka[3]; Ho-Kwang Mao[2]

[1]Advanced Photon Source, Argonne National Laboratory, 9700 South Cass Ave, Argonne, IL 60439, United States

[2]Geophysical Laboratory, Carnegie Institution of Washington, 5251 Broad Branch Rd, Washington, DC 20015, United States

[3]Consortium for Advanced Radiation Sources, University of Chicago, 5801 South Ellis Ave, Chicago, IL 60637, United States

In this contribution, we report the extention of nuclear resonant scattering techniques into the high-pressure and high-temperature sector relevant to the geophysical problem area. Nuclear resonant scattering techniques that utilize synchrotron radiation have provided new opportunities for the study of vibrational properties, magnetic properties, and iron valencies of condensed matter under extreme conditions. Here we will address nuclear resonant inelastic x-ray scattering (NRIXS), a method that uses probe nuclei with suitable resonances to measure the vibrational density of states, and synchrotron Mössbauer spectroscopy (SMS) for determination of valencies. Both methods are very sensitive to small amounts of material and take advantage of the high brilliance of synchrotron radiation, which makes micrometer-sized x-ray beams with high intensity possible. These properties allowed NRIXS and SMS investigations on materials under pressures in the Mbar regime using diamond anvil cells [1,2]. In general, NRIXS provides the phonon density of states [3] and sound velocities [4], whereas SMS gives access to the abundance of ferric iron in lower mantle polymorphs [2]. The introduction of Laser heating in combination with NRIXS and SMS at sector 3-ID of the Advanced Photon Source permits us now to conduct these studies under high pressure *and* high temperature. First results on iron metal and iron-containing perovskite $Fe_{0.1}Mg_{0.9}SiO_3$ up to 50 GPa and 1500 K will be presented to exemplify the usefulness of these novel techniques. This work is supported by the U.S. DOE-BES, Office of Science, under Contract No. W-31-109-Eng-38. [1] H.K.Mao, J.Xu, V.V.Struzhkin, J.Shu, R.J.Hemley, W.Sturhahn, M.Y.Hu, E.E.Alp, L.Vocadlo, D.Alfe, G.D.Price, M.J.Gillan, M.Schwoerer-Böhning, D.Häusermann, P.Eng, G.Shen, H.Giefers, R.Lübbers, G.Wortmann, Science **292**, 914 (2001) [2] J.M.Jackson, W.Sturhahn, G.Shen, J.D.Bass, (unpublished) [3] W.Sturhahn, T.S.Toellner, E.E.Alp, X.Zhang, M.Ando, Y.Yoda, S.Kikuta, M.Seto, C.W.Kimball, and B.Dabrowski, Phys.Rev.Lett. **79**, 3832 (1995) [4] M.Y.Hu, W.Sturhahn, T.S.Toellner, P.Mannheim, E.E.Alp, Phys.Rev. B **67**, 094304 (2003)

V41B-04 0845h

Solid-Solid Transitions at High-PT: Implications for the Earth's Core

Anatoly B Belonoshko[1,2] (+46 (018) 4715857; anatoly@fysik.uu.se); Rajeev Ahuja[3] (rajeev@fysik.uu.se); Sergey I Simak[3] (sergeis@fysik.uu.se); Börje Johansson[1,3] (borje@fysik.uu.se); Leonid Burakovsky[4] (burakov@lanl.gov); Dean L Preston[5] (dean@lanl.gov)

[1]Applied Materials Physics, Department of Material Science and Engineering, The Royal Institute of Technology, Stockholm 10044, Sweden

[2]Condensed Matter Theory Group, AlbaNova University Center, The Royal Institute of Technology, Stockholm 10691, Sweden

[3]Condensed Matter Theory Group, Department of Physics, Uppsala University, Uppsala 75121, Sweden

[4]Theoretical Division, Los Alamos National Laboratory, Los Alamos, NM 87545, United States

[5]Applied Physics Division, Los Alamos National Laboratory, Los Alamos, NM 87545, United States

Solid-solid (s-s) transtions can be separated in two groups: one pressure (P) induced and second temperature (T) induced. We will call P-induced s-s transitions those which occur on increasing the pressure (normally at low T) and T-induced s-s transitions those which occur on increasing T at a given P. While P-induced s-s transitions comparably easy to detect experimentally, T-induced s-s transitions might occur at such a high T

where they might be misinterpreted as melting. This is particularly true if high-PT experiment is not supported by information on the structure of the emerging phase. We will present theoretical results which show that Xe [1], Fe [2], and Mo [3] exhibit T-induced s-s transitions. These transitions are in good agreement with experimental data, which, however, was interpreted as melting. Our results allow us to suggest that the stable phase in the Earth inner core is body centred cubic iron not the hexagonal closed packed phase. This interpretation allows us to dismiss the major controversy between the "low" and "high" iron melting temperatures. Since *bcc* iron is less dense than *hcp* iron, the presumable amount of light elements in the core is less than was thought before. The melting temperature of iron in the center of the Earth, when the *bcc* phase is taken into account, is about 6900 K.

1. A. B. Belonoshko, R. Ahuja, and B. Johansson, Molecular dynamics study of melting and fcc-bcc transitions in Xe. *Phys. Rev. Lett.* **87**, 165505 (2001).
2. A. B. Belonoshko, R. Ahuja, and B. Johansson, Stability of the body-centred-cubic phase of iron in the Earth's inner core. *Nature* **424**, 1032 (2003).
3. A. B. Belonoshko, S. Simak, B. Johansson, L. Burakovsky, and D.L. Preston, High-pressure melting of Mo. *Phys. Rev. Lett.* (submitted).

V41B-05 0900h

Kawai-type apparatus equipped with sintered diamond and its application to melting of mantle materials

Eiji Ito (81-858-43-3753; eiito@misasa.okayama-u.ac.jp)

Atsushi Kubo (81-858-43-3823; akubo@misasa.okayama-u.ac.jp)

Tomoo Katsura (81-858-43-3754; tkatsura@misasa.okayama-u.ac.jp)

Micheal J. Walter (510-495-2722; mjwalter@lbl.gov)

Kawai-type (the 6-8 type) of multi-anvil apparatus has been widely used in the mineral physics because of its versatile abilities such as large volume and pressure environment of high hydrostacity. However, it has been realized for last two decades that the maximum attainable pressure is limited to ca. 27 GPa when using tungsten carbide (WC) as anvil material. We have tried to extend capability of Kawai-type apparatus by adopting sintered diamond (SD) cubes of 14 mm edge length with 1.5 or 2.0 mm truncations together with an octahedral magnesia pressure medium. Recently generated pressures of 54 GPa and 40 GPa were confirmed for 1.5 and 2.0 mm truncations, respectively, at room temperature based on the MgO pressure scale. Following above technical innovation, we have carried out melting experiments on peridotite and CI model mantle material up to 35 GPa to examine the hypothesis for crystal fractionation in deep magma ocean in early stage of the Earth's history. Powdered starting material was put directly into a small cylindrical Re heater, which was set in the octahedron with a LaCrO3 sleeve. The sample was heated to ca. 2500° C for 2-3 min at the prescribed load. The quenched products were made to polished sections, which were examined by electron microscopy and then analyzed by the electron probe micro analyzer. In peridotite, ferropericlase (Fp) is the liquidus phase up to about 30 GPa. Both Fp and Mg-perovskite (Mg-Pv), however, coexist on the liquidus at 31 GPa, indicating multiple saturation of these phases. At higher than 32 GPa the front of Fp grains moves back from the liquidus to the slightly lower temperature region and Mg-Pv becomes the liquidus phase. Ca-perovskite (Ca-Pv) crystallizes at a fairly lower temperature than Fp and Mg-Pv at pressures up to ca. 29 GPa. However the crystallization temperatures of Fp and Ca-Pv become closer with increasing pressure, and the former might be only a few degrees higher than the latter at 33 GPa. In CI mantle, on other hand, liquidus phase changes from majorite (Mj) to Fp in pressures of 23-25 GPa. At higher than 28 GPa, Mj and Fp completely disappear in the super solidus region, and the liquidus phase is Mg-Pv followed down temperature by Ca-Pv. Differentiation by crystal fractionation of Mg-Pv, Fp, and Ca-Pv in a deep magma ocean has been examined for a CI chondritic and two peridotitic bulk silicate Earth models, using chemical compositions of theses phases coexisted with melt in peridotite charge at 33 GPa. Mass balance indicates that subtraction of about 40 percent Mg-perovskite and 2 percent Ca-perovskite from a CI chondritic bulk silicate Earth yields a residual melt close to a model fertile upper mantle composition. A crystal layer composed of Mg- and Ca-perovskites would pile up to a depth about 1400 km, and may be characterized as an enriched and possibly heat-producing reservoir by the high capability of Ca-perovskite to accommodate large cations such as La and alkaline elements. For peridotitic bulk silicate Earth models, fractionation would be quite limited, up to 10 percent of Mg-perovskite in addition to trace amount of Ca-Pv.

V41B-06 0915h

Deformation Experiments in the D-DIA Using High-Resolution Monochromatic Diffraction

Yanbin Wang[1] (+1-630-252-0425; wang@cars.uchicago.edu)

Takeyuki Uchida[1] (uchida@cars.uchicago.edu)

Mark Rivers[1] (rivers@cars.uchicago.edu)

William Durham[2] (durham1@llnl.gov)

[1]GSECARS, Univ. Chicago, 9700 S. Cass Ave., Argonne, IL 60439, United States

[2]Lawrence Livermore National Laboratory, 7000 East Ave., Livermore, CA 94550, United States

Differential stresses in polycrystalline MgO and CsCl samples under controlled axial strain are determined as a function of pressure and temperature in the Deformation DIA (D-DIA: Wang et al., RSI, 74, 3002, 2003) using monochromatic diffraction, with a two-dimensional X-ray detector and X-ray transparent sintered cubic boron nitride (cBN) anvils. Radiographic images and diffraction Debye rings are repeatedly recorded at various pressures during constant strain rate deformation. From the sample length change in the X-ray image, total sample axial strain can be determined. From the distortion of the diffraction rings recorded over the entire 360° azimuth angles, elastic lattice strains can be accurately measured as a function of pressure, temperature, and differential stress. Linear lattice elastic theory is applied to convert lattice strains to differential stress (Singh, J. Appl. Phys., 73, 4278, 1993). The ability of the D-DIA to control differential stress separately from pressure (by deforming the sample while maintaining constant pressure) allows us to establish criteria for detecting yielding and to examine pressure and total strain dependence on yield strength. Analyses indicate that Singh's theory is adequate in describing the stress-strain behavior within the elastic regime. However, as some crystallites begin to yield, stress state becomes heterogeneous on the grain scale, resulting in significant change in the apparent anisotropy factor. This change can be considered as an indicator for the onset of yielding. Such details contain important information on rheology but previously could not be observed in conventional deformation and high-pressure (such as the diamond-anvil cell or multianvil) devices. Work is underway to model the stress distribution in polycrystalline samples after yielding, in order to connect stresses measured at the grain-to-grain level to conventional the force-over-the-area measurements. Our findings also raise questions on previous elastic constant measurements using diffraction, where differential stress levels are expected to be high. These data are likely to be influenced by heterogeneous yielding, in which case the elastic data thus obtained would be erroneous.

V41B-07 0930h

Density Measurement of Silicate Glass by In Situ X-ray Absorption Method

Satoru Urakawa[1] (81-86-251-7885; urakawa@cc.okayama-u.ac.jp)

Ryota Ando[2] (andou_rt@ganko.tohoku.ac.jp)

Eiji Ohtani[2] (ohtani@mail.cc.tohoku.ac.jp)

Yoshinori Katayama[3] (katayama@spring8.or.jp)

[1]Department of Earth Sciences, Okayama University, 3-1-1 Tsushima naka, Okayama 7008530, Japan

[2]Institute of Mineralogy, Petrology and Economic Geology, Tohoku University, Aoba-ku, Sendai 9808577, Japan

[3]Synchrotron Radiation Research Center, Japan Atomic Energy Research Institute, 1-1-1 Koto, Mikaduki 6795148, Japan

Density is an important physical property to understand high-pressure behaviors of silicate glass and melt. There, however, have not been adequate methods to determine the density of silicate glass and melt at high pressures and high temperatures. We applied x-ray absorption method to silicate glass with low x-ray absorption coefficient, by using a diamond sample container. We measured the densities of basalt composition glass and Fe-bearing sodium silicate glass up to 5 GPa and 773K using synchrotron radiation. High-pressure x-ray absorption experiments were conducted at BL22XU in SPring-8, where the cubic type multi-anvil press, SMAP180 is installed and a monochromatic x-ray is available. To detect the absorption contrast between silicate and surrounding materials, we used a single crystal diamond ring as a sample container and a boron-epoxy resin as a pressure-transmitting medium. Intensities of incident and transmitted x-ray were measured by ion chambers, in which we used the monochromatic x-ray with 25.13 keV. We can evaluate the density of glass from the x-ray absorption profile along a radial direction of a cylindrical sample, because deformation of diamond ring is very small in this pressure range and x-ray absorption of diamond is lower than silicate. We observed 20-30 % increase of densities of basalt composition glass and Fe-bearing sodium silicate glass along room temperature compression from 0.1 MPa to 5 GPa, and also detected density increase in both silicate glasses with increasing temperature at high-pressure by structural relaxation.

V41B-08 0945h

Vibrational Spectra of Hot Dense Molecular Fluids: Tabletop Apparatus for Probing Planetary Interiors

Bruce J. Baer[1] ((925)424-3339; baer4@llnl.gov)

Choong-Shik Yoo[1] ((925)-422-5848; yoo1@llnl.gov)

[1]Lawrence Livermore National Laboratory, 7000 East Ave M/S L-41, Livermore, CA 94550, United States

Spectroscopic information on simple molecules at high temperatures and pressures are necessary for understanding the interiors of the Jovian planets. These conditions easily exceed 2000K and 10 GPa. We shall demonstrate that it is possible to exceed those conditions (statically) and obtain spectroscopic information on such hot dense fluids. This experimental method requires the use of non-linear spectroscopy and CW laser heating on samples that are under pressure inside a diamond-anvil cell. Spectra are obtained by using a four wave mixing technique: Coherent Anti-Stokes Raman Spectroscopy. The sample heating is accomplished by using an in-situ microscopic tungsten toroid as a laser target. By combining these techniques simultaneously, vibrational spectra with relatively high signal to noise can be obtained despite the enormous thermal background generated by the incandescence of extremely hot laser heated material. Temperatures can be measured not only by fitting the Planck radiation to a graybody, but by the spectroscopic evidence of a Boltzmann distribution of molecules in their excited vibrational quantum levels. Our initial experiments will describe these technical developments and demonstrate their success using nitrogen samples.

V41C MCC: Level 1 Thursday 0830h

Minerals, Melts, and Fluids Posters

Presiding: **M Barton,** Ohio State University

V41C-0303 0830h POSTER

Enthalpies of Mixing in Sodium Silicate Glasses and Relevance to Adam-Gibbs Theory

Guy Hovis[1] (610-330-5192; hovisguy@lafayette.edu)

Philippe Jarry[2] (p.jarry@euroglas.com)

Michael Toplis[3] (mtoplis@crpg.cnrs-nancy.fr)

Pascal Richet[2] (richet@ipgp.jussieu.fr)

[1]Lafayette College, Department of Geology and Environmental Geosciences, Easton, PA 18042, United States

[2]Laboratoire de Physique des Géomatériaux, Institut de Physique du Globe, 4, place Jussieu, Paris 75252, France

[3]CRPG-CNRS, BP20, Vandoeuvre-les-Nancy F-54501, France

Solution calorimetric measurements have been made in 20.1 wt % hydrofluoric acid at 50° C on binary Na_2O-SiO_2 glasses ranging in composition from 0 to 50 mol % Na_2O. The initial calorimetric data for compositions between 20 and 50 mol % Na_2O were highly variable, determined later to be due to the development of Na carbonate on the glass surfaces. However, additional measurements using minimally-ground specimens that had been remelted shortly before the calorimetric dissolutions produced highly reproducible results. After adjustment of the data for glass transition temperature (Richet et al., 1984, J. Amer. Ceram. Soc.), the results show nearly linear ("ideal") behavior of the heats of solution between 50 % Na_2O and 30-35 % Na_2O. However, positive enthalpies of mixing (H_{ex}) are evident in the compositional region between 0 and 30-35 mol % Na_2O, with maximum magnitudes of H_{ex} on the order of 5 kJ/mol relative to 0 and 35 % Na_2O end members. Within the framework of the Adam-Gibbs theory of structural relaxation, viscosity and heat capacity data may be combined to determine configurational entropies of silicate glasses. When applied to sodium silicate glasses (Toplis, 2001, Chemical Geology), positive entropies of mixing (S_{ex}) are calculated for compositions between 0 and 30 mole

V