



Enthalpy of hydration of mgso4

Hydrated enthalpy is an energy change for converting one mole of an anus substance into one mole of hydrated substance. To find this number, it is necessary to first calculated using the temperature change of water, the heat capacity of the substance, and the weight of the mixture. In this experiment, mgSO4 and MgSO4. 7H2O were used to calculate the enthalpy of hydrate between the two. Experiment A Styrofoam cup and stirring bar were obtained first and weighed again and this new mass was recorded. The cup was then placed on a mixing plate set high from the medium and its temperature was recorded every 30 seconds for 4.5 minutes. An unknown amount of MgSO4 salt was added to the cup and its temperature was recorded for 15 minutes per minute. Finally, we weighed the cup and recorded the final mass. MgSO4 and MgSO4 were repeatedly arranged at 7H2O. Results Measurement MgSO4 · 7 H2O Trial MgSO4 Cup and Stirring Rod Trial Mass (g) 7.85 7.41 Cup Mass, Stirring Rod, Water (g) 107.21 106.70 Mass of Water (g) Mass of Cup, Stirring rod, stirring ro transferred during dissolution -4890. Δ Hdissolution (°C) 1.0 kJ) -92600. (-92.6 kJ) Enthalpy of Hydrogen: -106.6 kJ Time (minutes) Temperature of MgSO4 · 7 H2O solution (°C) Temperature of MgSO4 solution (14.0 kJ) -92600. (-92.6 kJ) Enthalpy of Hydrogen: -106.6 kJ Time (minutes) Temperature of MgSO4 · 7 H2O solution (°C) Temperature of MgSO4 · 7 H2O solution (°C) 10.0 v.a n/a 0.5 20.90 21.63 1.5 20.90 21.63 1.5 20.90 21.63 1.0 20.90 21.63 2.0 20.90 21.63 1.0 20.90 21.63 1.0 20.90 21.63 1.0 20.90 21.63 2.0 20.90 21.63 1.0 20.90 21.63 1.0 20.90 21.63 1.0 20.90 21.63 1.0 20.90 21.63 1.0 20.90 21.63 1.0 20.90 21.63 1.0 20.90 21.63 1.0 20.90 21.63 1.0 20.90 21.60 3.0 20.90 21.63 1 19.32 29.50 10.0 19.35 31.20 11.0 19.38 31.65 12.0 19.40 31.65 12.0 19.40 31.60 13.0 19.42 3 1.44 14.0 19.49 31.28 15.0 19.50 31.20 16.0 19.50 31.20 16.0 19.51 30.91 17.0 19.58 30.76 18.0 19.69 30.23 Calculations To find the weight of the salt used, I subtracted the weight of the cup with just the steering rod from the steering rod from the steering rod from the weight of the cup with just the steering rod from the weight of the cup with just the steering rod from the weight of the cup with just the steering rod and water. To find the mass of water, I subtracted the weight of the cup with just the steering rod from the weight of the cup with just the steering rod and water. To find the mass of water, I subtracted the weight of the cup with just the steering rod from the weight of the cup with just the steering rod from the weight of the cup with just the steering rod and water. To find the mass of water, I subtracted the weight of the cup with just the steering rod from the weight of the cup with just the steering rod from the weight of the cup with just the steering rod from the weight of the cup with just the steering rod from the weight of the cup with just the steering rod from the weight of the cup with just the steering rod from the weight of the cup with just the steering rod from the weight of the cup with just the steering rod from the weight of the cup with just the steering rod from the weight of the cup with just the steering rod from the weight of the cup with just the steering rod from the weight of the cup with just the steering rod from the cup with just the steering rod from the weight of the cup with just the steering rod from the cup with the mole of the melt used, I divided the mass of salt by its molar mass. To find the temperature change, the final temperature to ang ducted from the initial temperature. To find the heat capacity of the mixture) * (ΔT) was used. To find the heat capacity of the mixture) * (ΔT) was used. To find the temperature to ang ducted from the initial temperature to ang ducted from the initial temperature to ang ducted from the initial temperature. To find the heat capacity of the mixture) * (ΔT) was used. To find the mass of solum) was used. To find the mass of solum to find the mass of solution to find the mass of solutio ΔH dissorution of MgSO4. 7H2O. Discussion/Conclusion MgSO4 I was surprised that mgSO4 I was net temperature changes seems to be gradually jumping after adding salt. I think this is because my lab partner forgot to turn on the mixer, so the salt wasn't completely mixed at first Other than that, the procedure worked. -106.6 kJ hydration enthalpy seems pretty high. Water take 4.184 kJ to raise only 1°C, so 106.6 kJ seems like a lot of energy. C. Delve into the chemistry of scientific chemical reactions and properties. In this video tutorial, we will show you how to determine the enthalpy change in hydration of MgSO4 kJ seems like a lot of energy. C. Delve into the chemistry of scientific chemical reactions and properties. In this video tutorial, we will show you how to determine the enthalpy change in hydration of MgSO4 kJ seems like a lot of energy. (magnesium anhydrous). IT Chemistry: Magnesium sulfate is used as an example of how enthalpy changes are determined. 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Find articles from Friedrich Schiller University, Jena, Germany. Find articles from Friedrich Schiller University, Jena, Germany. Fisik, Abteiln Mineralogy), Friedrich Schiller University, Jena, Germany. Find articles from Friedrich Schiller University, Jena, Germany. Find articles from Friedrich Schiller University of Salzburg, Mineralogy (Mineralogy), Friedrich Schiller University, Jena, Germany. Find articles from Friedrich Schiller University, Jena, Germany. Find articles from Friedrich Schiller University of Salzburg, Mineralogy (Mineralogy), Friedrich Schiller University of Salzburg, University of Salzburg, Sa Salzburg and Austria. Find articles by Edgar Dux 4 department of the Faculty of Rule, Bochum, Germany. A Dominic Fortes 2: Institute of Geology, Mineralogy and Geophysics, University of Rule, Bochum, Germany. Abeiln Mineralogy, University of Salzburg, University of Rule, Bochum, Germany. Abeiln Mineralogy, University of Salzburg, University of Rule, Bochum, Germany. Abeiln Mineralogy, University of Salzburg, University of Salzburg, University of Rule, Bochum, Germany. Abeiln Mineralogy, University of Salzburg, University of Salzburg, University of Rule, Bochum, Germany. Abteiln Mineralogy, University of Salzburg, University of Salzburg, University of Salzburg, University of Friedrich Schiller 1. Statute of Geology, Mineralogy and Geophysics, University of Salzburg, University of Salzburg, University of Friedrich Schiller, Institute of Geology, Mineralogy and Geophysics, University of Salzburg, University of Salzburg, University of Salzburg, University of Friedrich Schiller, Institute of Geology, Mineralogy, University of Salzburg, University of S thermodynamic database of mgSQ4.nH2O systems has been refined by mathematical programming (MAP) analysis. As can be seen from the resulting phase diagram, the star keyt is unstable throughout the T-% RH range. Due to the motion limits of kiselite formation, star Kate's unstable throughout the T-% RH range. Due to the motion limits of kiselite formation, star Kate's unstable development may be possible under Martian conditions. Keywords: Mg sulfate - star kate - thermodynamic data — entropy — enthalpy-thermodynamics.astrobiology 12,1042-1054. A Three different multi-shapes are described from laboratory experiments: MgSQ4 and nH2O (1<<11) in many different hydration forms (Table 1). Most of them have been found as minerals on Earth (Peterson, 2011), and recent space missions have supported the presence of significant amounts of Mg sulfuric acid in Martian soils and sediments (e.g., Chipera and Baniman, 2007; Roach et al. referred to in 2009 and in it). Recently, enthalpy of formation from elements of keyserite (n=1), sanderite (n=2), hexahydrite (n=6), and epsemite (n=7) (2009) was measured (Grevel and Majzlan, 2009). These authors then combined enthalpy data as a function of temperature and relative humidity with other experimental studies on the stability of some Mg-sulfate hydrates, including Epsité, Hexahidrito, Star Kate (n=4), and kiselite (van't Hoffman et al., 1912; Chou and Seal, 2003, 2007) 1 Obtain an internal and consistent thermodynamic database of systems MgSQ4–H2O with rigorous mathematical programming (MAP) analysis. As a result, a phase diagram shown in FIG. As concluded by Grevel and Magislan (2009), star Kate's metastatic presence, making this phase a major reaction. However, star Kate's data in the result of the dehydration reaction. However, star Kate's data in the result of the dehydration reaction. However, star Kate's data in the result of the dehydration reaction. However, star Kate's data in the result of the dehydration reaction. However, star Kate's data in the result of the dehydrati the database of Grevel and Magislan (2009) was derived from estimates. Therefore, direct measurement of this stage was strongly desired to define the main purpose of this study. We obtained synthetic starkeyt by solutioning the amount of heat to water at room temperature. Star Kate's standard entropy was derived from low temperature thermal capacity measurements obtained with the Physical Property Measurement System (PPMS). Furthermore, enthalpy in the formation of this study. We obtained synthetic starkeyt by solutioning the amount of heat to water at room temperature. Star Kate's standard entropy was derived from low temperature thermal capacity measurements obtained with the Physical Property Measurement System (PPMS). Furthermore, enthalpy in the formation of the interature are literature are literature step-by-step references a-MgSO40Rentzeperis and Soldertose, 1958; Fortes et al.1962; Yamaguchi and others, 2007y-MgSO40Rowe, 1967; Dimon and Kato, 1984 Key Seserite 1 Hawthorne, 1., 1987Reagent one hydrate 1 Sipera and Baniman, 2007; Grindrod and others, 2010; Steiger and others, 20115/4 hydrotb1.25van't Hoff and Dawson, 1899; Hodenberg and Kyun, 1967 Sanderite 2Ma and others, 2009a2.4 Hydratech 2.4 Chiterra and Baniman, 20072.5 Hydratech 2.4 Chiterra and Baniman, 20072.5 Hydratech 2.4 Chiterra and Baniman, 20072.5 Hydratech 2.4 Chiterra and others, 2009bTrihydrate3Hodenberg and Kühn, 1967; Fortes and others, 2005 Meridian Ait 11 Peterson and the King, 2006; Peterson and others, 2007; Fortes et al., 2008Steiger et al. (2011) reported new measurements of equilibrium relative humidity to some stable and metastatic hydrated dehydration equilibrium in the MgSO4-H2O system (see Fig. 1). These measurements serve as an additional constraint for MAP procedures to obtain a revised internally consistent thermodynamic dataset of magnesium sulfate hydrates. Star Kate mgSO4-6H2O, in a drying cabinet (4 days) at about 320K (Steiger et al., 2011) (Fluka 00627 p.a.) produced in the Department of Chemistry (University of Hamburg, Germany) by dehydration. The XRD pattern was obtained by a transmission stedi P powder diffrometer (STOE, Germany) using Cu-Kα radiation. The XRD pattern was compared with the UCRDs atonderd 24 720. Euthormaco, powder VRD measurements abaited with Simero P 500 different value in a drying cabinet and then sent to Bochum by regular mail. The XRD pattern was obtained by a transmission stedi P powder diffrometer (STOE, Germany) using Cu-Kα radiation. The XRD pattern was compared with the UCRDs atonderd 24 720. Euthormaco, powder VRD measurements abaited with Simero P 500 different value in the UCRDs atonderd 24 720. JCPDS standard 24-720. Furthermore, powder XRD measurements obtained with Siemens D 500 diffrests were scanned every 2s between 3° and 65°20 and collected before and after Cp measurements in Salzburg. MgSO4 solution without stirring (Fortes and Leme Caillot, 2010). Crystals grown in this way are clusters of euhedral colorless plates 1 to 2 mm long and 0.1 to 0.5 mm thick (Figure 2). After extraction from the solution, the crystals of MgSO 4 and 3H2O became somewhat dull. However, batches of crystals that were not unstable, as reported by Hodenberg and Kyun (1967), were stored in small glass jars for 10 days and endured repeated exposure to warm air (~30 °C) and examination under a microscope. Thus, some crystal fragments can be transported to Jena by email for use in heat measurements. Once powdered under air, this phase hydrates so rapidly that measurements requiring powder samples were not made with this material. The crystal structure mgSO4 and 3D2O in critical conditions were previously measured by high-resolution neutron powder diffring at ISIS neutron spray sources (Fortes et al., 2010). Dimensions of room temperature cells, a=8.1925(2) Å, b=10.9210(2) Å, c=12.3866(4) Å and the space group Pbca agree with the previously published values of Hodenberg and Kühn (1967) for the protonized form (MgSO43H2O) used in this work. For the solution calorific value measurement, a commercially available IMC-4400 is temperature microcalorimeter (Caloric Measurement, a commercially available IMC-4400 is temperature microcalorimeter (Caloric Measurement, a commercially available IMC-4400 is temperature microcalorimeter (Caloric Measurement, a commercially available IMC-4400 is temperature microcalorimeter (Caloric Measurement, a commercially available IMC-4400 is temperature microcalorimeter (Caloric Measurement, a commercially available IMC-4400 is temperature microcalorimeter (Caloric Measurement, a commercially available IMC-4400 is temperature microcalorimeter (Caloric Measurement, a commercially available IMC-4400 is temperature microcalorimeter (Caloric Measurement, a commercially available IMC-4400 is temperature microcalorimeter (Caloric Measurement, a commercially available IMC-4400 is temperature microcalorimeter (Caloric Measurement, a commercially available IMC-4400 is temperature microcalorimeter (Caloric Measurement, a commercially available IMC-4400 is temperature microcalorimeter (Caloric Measurement, a commercially available IMC-4400 is temperature microcalorimeter (Caloric Measurement, a commercially available IMC-4400 is temperature microcalorimeter (Caloric Measurement, a commercially available IMC-4400 is temperature microcalorimeter (Caloric Measurement, a commercially available IMC-4400 is temperature microcalorimeter (Caloric Measurement, a commercially available IMC-4400 is temperature microcalorimeter (Macori Measurement, a commercially available IMC-4400 is temperature microcalorimeter (Macori Measurement, a commercially available IMC-4400 is temperature microcalorimeter (Macori Measurement, a commercially available IMC-4400 is temperature microcalorimeter (Macori Measurement)) available IMC-4400 is temperature microcalori solvent (25 mL of deionized water) contained in a sealed polyetherether ketone cup of 60 mL was inserted into a pellet of about 20 mg and weighed at a constant temperature of 25 ° C. (±0.0005 ° C.). During stabilization (8 hours) and experiments (80 to 100 minutes), the solvent was stirred with a SiO2 glass stirrer driven by a motor located about 40 cm from the active zone of the instrument. A fine-grained star keyet sample was pushed into a pellet of about 20 mg and weighed with a microbalance with an accuracy of 0.002 mg (as stated by the manufacturer). On the other, the carse grain size tri hydrate sample was dropped into the solvent through a SiO2 glass tube to measurement experiment without pulverization. Immediately after weighed and used for the heat generated or consumed during dissolution. The solution was always newly prepared, and the final sugar content of Mg2+ was the same in each run. This type of heat measurement does not require consideration of dilution (or concentration) effects. The caloric effect was calculated by dissolving 20 mg pellets of KCl in 25 g of deionized water. Before each calibration measurement, potassium chloride was heated overnight in a furnace at 500 ° C. to remove adsorbed water. The expected thermal effect of the calibration run was calculated from Parker (1965). The weight loss of the two star Kate samples (50 mg each) was measured with N2 rich air (1 atm) in the temperature to 600 ° C. at a heating rate of 5 ° C. / min. Differential thermal analysis (DTA) and thermogravity analysis (TG) nstructed physical property measurement system (PPMS). Established at the University of Salzburg. About 20 mg of the powder sample was sealed in an AI pan and the powder sample was sealed in an AI pan and the powder sample was sealed in an AI pan and the powder sample was sealed in an AI pan and the powder sample was sealed in an AI pan and the powder sample was sealed in an AI pan and the powder sample was sealed in an AI pan and the powder sample was sealed in an AI pan and the powder sample was been at the University of Salzburg. re (5-300K) thermal capacity behavior was investigated using a quantum-c when cooled from 300 K at a number interval. The complete PPMS experiment for measuring Cp consisted of additional runs and sample runs. During the entire ensemble was measured. The net thermal capacity of the sample is given by the difference between the two measurements. To convert PPMS data from µJ units, a uncertainty of 0.02 mg ± sample weight was adopted. K-1 to J. Differential scanning heat measurement wing a Parkin Elmer diamond DSC with a temperature range of 270K<7<300K was performed to confirm the reproducibility of PPMS measurements around ambient temperature (Dax and Benisek, 2011). The powder sample weight was placed in parkin elmer at gas flow and the manometer block was kept at a constant temperature of 243.3 K in the Parkin Elmer Intracooler. The growth of ice crystals on the thermometer block was prevented by dry air flow (200 mL·min-1). In addition, the cover heater was turned off. The full survey consisted of three separate measurements: blanks, references, and sample measurements. Before the sample measurement, the DSC was calibrated with a reference execution using a synthetic single crystal of corundund (31.764 mg) with a heat capacity value obtained from the National Standards Authority Certificate (Ditmars et al., 1982). Two measurement series were carried out. Five experiments were conducted on Star Kate, and four were conducted on Star Kate, and four were conducted on tri hydrates, the crystals have $(aq)04Mg (cr) + S (cr) + S (cr) + S (cr) + 202 (g) = \alpha-MgSO4 (cr)-1288.5 \pm 0.5d5H2 (g) + 1/202 (g) = H2O (l)-285.8 \pm 0.1e6starkeyeMg (cr) + S (cr) + 402 (g) + 4H2(cr)-2498.7 \pm 1.16$ hydrates, the literature (Wagman and others, 1987; 2009, Grevel and Magizlan). In the case of tri hydrates, the literature (Wagman and others, 1987; 2009, Grevel and Magizlan). In the case of tri hydrates, the literature (Wagman and others, 1986; Pavlan and others, 1987; 2009, Grevel and Magizlan). In the case of tri hydrates, the literature (Wagman and others, 1987; 2009, Grevel and Magizlan). In the case of tri hydrates, the literature (Wagman and others, 1987; 2009, Grevel and Magizlan). In the case of tri hydrates, the literature (Wagman and others, 1986; Pavlan and Others, 1986; Pavlan and Others, 1987; 2009, Grevel and Magizlan). In the case of tri hydrates, the literature (Wagman and others, 1986; Pavlan and Others, 1986; Pavlan and Others, 1987; 2009, Grevel and Magizlan). In the case of tri hydrates, the literature (Wagman and others, 1986; Pavlan and Others, 1986; Pavlan and Others, 1987; 2009, Grevel and Magizlan). In the case of tri hydrates, the literature (Wagman and others, 1986; Pavlan and Others, 1986; Pavlan and Others, 1987; 2009, Grevel and Magizlan). In the case of tri hydrates, the literature (Wagman and Others, 1986; Pavlan and Others, 1986; Pavlan and Others, 1987; 2009, Grevel and Magizlan). In the case of tri hydrates, the literature (Wagman and Others, 1986; Pavlan derived enthalpy of formation from the element is equal to -2210.3±1.3 kJ·mol-1. As shown in FIG. 3, assuming a linear correlation between the number of Mg sulfate hydrate, the enthalpy of the generation of each Mg-sulfate hydrate, the enthalpy of the generation of each Mg-sulfate hydrate using the n-water molecules and the enthalpy of the generation of each Mg-sulfate hydrate using the n-water molecule can be presumed to have a high correlation between the number of Mg sulfate hydrate using the n-water molecules and the enthalpy of the generation of each Mg-sulfate hydrate. for Mg-sulfate hydrates. It should be noted that the correlation is very high, since enthalpy from the element (not the formation of each magnesium anhydrous, different from the characteristics determined on a trial. Due to the delicate phase equilibrium considered in this paper such a difference means a shift in the relative humidity of the equilibrium reaction at a predetermined temperature of 100% or more, completely shifting some curves from the T-RH space. Therefore, such estimates of (Meridian Eyet) (n=11), it is -4584.3 kJ·mol-1. The difference between the two values is also well documented with simple linear pitfalls where the alignment fits the thermodynamic data. Two different batches of powdered star Kate samples were analyzed. The weight of the untreated batch is 57.50 mg and the ground sample. The results of the raw samples are roughly equivalent. Star Kate loses water in five stages. The total loss was calculated at 36.9% for ground samples and 37.0% for untreated materials. These observations are in good agreement with the theoretical value of 37.4%. Therefore, we conclude that the grinding did not affect the state of hydration of the sample. As a result of analyzing the TG curve (FIG. 4), it was concluded that Starkeyt dehydrates to sanderite (n = 2) in two stages. The water loss of 18.6% is very well consistent with the theoretical value of 18.7%. In the next step,Occurs against kiselite - 27.8% weight loss. The final dehydration of the keyserite seems to occur in two more steps. A single PPMS measurement was performed on a 21.618 mg ground star keyt sample. Samples confirmed to be star Kate by XRD just before and after the measurement was performed on a 21.618 mg ground star keyt sample. Samples confirmed to be star Kate by XRD just before and after the measurement had lost 0.124 mg of weight during experiments considered in the data analysis All starkeyt measurement heat capacities are listed in Table 3 and shown in Figure 5. This low temperature PPMS data is described in table 3a, DSC data (around the surrounding T) of Table 3b. Star Kate's smooth thermodynamic function to 0 K: (2) Starkeyt's raw experimental lowtemperature molar heat capacity obtained from the PPMS experiment. Cp. (J- K-1 Mole-1) σ -Cp (J- K-1 mol-1) 5.0670.0590.002155.4340.0730.001825.8280.0910.00156.2480.1130.002276.7050.1420.002157.1590.1740.001637.6710.2170.002018.2230.2720.002428.8130.3420.002999.4430.4290.0035310.1180.5280.0357510.8530.6830.0043911.6290.8610.0053712.4601.0850.0065213.3521.3640.0079014.3081.7030.0097415.3322.1300.0122116.4332.6530.0144117.6103.2770.0180518.8744.0310.00224720.2204.9370.0266321.6716.0150.0616623.2257.2560.0595124.8898.7200.00 475326.68010.4200.0651828.59812.4010.0657630.65514.6170.0785632.85917.1680.0912235.22320.0240.1117837.75823.1910.1308440.47426.7400.1582143.38530.5680.2107146.50234.7020.2016549.84339.1470.2276453.42743.9850.2587257.27349.1960.5469561.40354.4610.3297365.82560.1980.4681370.55866.2120.4188075.62772.5530.4339981.05679.1550.4977586.87585.7650.5352093.11292.6610.5713599.812100.080.60159106.99107.780.91490114.68115.250.8 8310122.94123.930.73427131.78132.170.90458141.28141.611.2296151.44151.080.88392162.40161.381.2763174.06171.531.1671186.55181.951.0242199.9 4193.061.0749214.26203.971.6468229.63214.971.7883246.10226.991.0373263 .71238.541.0712282.55250.611.1671186.55181.951.0242199.9 4193.061.0749214.26203.971.6468229.63214.971.7883246.10226.991.0373263 .71238.541.0712282.55250.611.1671186.55181.951.0242199.9 4193.061.0749214.26203.971.6468229.63214.971.7883246.10226.991.0373263 .71238.541.0712282.55250.611.1671186.55181.951.0242199.9 4193.061.0749214.26203.971.6468229.63214.971.7883246.10226.991.0373263 .71238.541.0712282.55250.611.1671186.55181.951.0242199.9 4193.061.0749214.26203.971.6468229.63214.971.7883246.10226.991.0373263 .71238.541.0712282.55250.611.1671186.55181.951.0242199.9 4193.061.0749214.26203.971.6468229.63214.971.7883246.10226.991.0373263 .71238.541.0712282.55250.611.1671186.55181.951.0242199.9 4193.061.0749214.26203.971.6468229.63214.971.7883246.10226.991.0373263 .71238.541.0712282.55250.611.1671186.55181.951.0242199.9 4193.061.0749214.26203.971.6468229.63214.971.7883246.10226.991.0373263 .71238.541.0712282.55250.611.1671186.55181.951.0242199.9 4193.061.0749214.26203.971.6468229.63214.971.7883246.10226.991.0373263 .71238.541.0712282.55250.611.1671186.55181.951.0242199.9 4193.061.0749214.9261.971.7883246.10226.991.0373263 .71238.541.071282.55250.611.1671186.55181.971.071282.55250.611.1671186.55181.971.071282.55250.611.1671186.55181.971282.55250.611.1671186.55181.971282.55250.611.1671186.55181.971282.55250.611.1671186.55181.971282.55250.611.1671186.55181.971282.55250.611.1671186.55181.971282.55250.611.1671186.55181.971282.55250.611.1671186.55181.971282.55250.611.1671186.55181.971282.55250.611.1671186.55181.971282.55250.611.1671282.55181.971282.55250.611.1671282.571 1)281.91250.960.5823286.39253.680.4351290.86256.480.4166 Smoothing of Star Kate's mordynamic function at temperatures from 5 to 298.15 K (M=192.4296 g mol-1) (H(T) - H(0)/T(J· K-1 Mole-1)-(G(T) - H(0)/TEinstein, Schottky parameters (Eq. 2) obtained from fit thermal capacity data; Tswitch=35.68 KTangersθDneθEnsθST<:Tswitch4.0800271.32690.3346100.12490.018047.5581T> Tswitch7.9937460.82157.73711013.32412.0108146.9466.9466.d(θE), and S, respectively, are adjustable parameters. In order to optimally express the low temperature Cp behavior for experiments, the data were divided into low and high temperature intervals. Therefore, two pairs of calibration parameters are listed in Table 3d and should be used under and above Tswitch, respectively. As you can see from Figure 5, the agreement between PPMS and DSC data around the ambient temperature is very good. At 295 K, the latter is 0.13% larger. As expected for simple compounds, no abnormalities are observed in cp data. Star Kate Results Standard Entropy, 254.48±2.0 J. K-1 mol-1, Pavan and Pitzer (1987), 254.76 J. K-1 mol-1, and optimized value 259.9 J. Krevel and Mazlan (2009) from G-1 Mole-1. Obviously, 246.86 J K-1 mol-1 (De Kock, 1986) can be discarded. All Mg-sulfate hydrates change their hydration status according to local temperature and humidity conditions. In their case study, Grevel and Majzlan (2009) performed a MAP analysis based on simultaneous processing of heat data and constraints given from related reversal experiments (van't Hoffman et al., 1912; Chou and Seal, 2003, 2007) According to hydrated dehydration reaction (3), standard Gibbs free energy (kJ·mol-1) is given as (4) for this reaction, the standard enthalpy of the reaction., reaction standard entropy; K, equilibrium constant. R=8.31451 J.mol-1. K-1, gas temperature brackets indicate high hydrated sulfates, i.e. T-% RH conditions in which the reacting material has been proven to be stable. The other bracket, on the remaining terms of 5, It is kept constant throughout the MAP procedure: (7)Grevel and Maizlan (2009) Due to the limited amount of data available. the magnitude of the error caused by this assumption is unknown <// Tswitch4.0800271.32690.3346100.12490.018047.5581T> However, it may not be large because the wide area is less than 100 K. Nevertheless, we currently have experimental data for important Mg sulfate hydrate selite (Frost et al., 1957), Star Kate (this study), Six Hydrates (Cox et al., 1957), Star Kate (this study), Six Hydrates (Cox et al., 1957), and Epsepmite (Gurevich et al., 2007). In the case of Star Kate, the data reported in this study in the temperature domain T=229-303K (cf. Table 3a, 3b) listed the commonly used Meyer-Kelly polynomial (8) conformance parameters a, b, and c in Table 4 along with parameters a, b, and c in Table 4 along with parameters a, b, and c in Table 4 along with parameters of other minerals collected from Grevel and Majzlan (2009). Some MgSO4 Hydrate Meyer-Kelly Cp Parameters 103.124107.925203.1677218.7748b0.16960.55320.66870.7 In the 465c-1794051-1048894-4466548-4866544 survey, the MAP analysis conducted by Grevel and Majzlan (2009) was repeated. Stopped the assumption Δ Cp=0 for all reactions under consideration. The fume city of steam is calculated by grevel and Chatterjee (1992) state equations based on haar et al. (1984) data and is implemented in software used for MAP analysis (cf. Grevel and Majzlan, 2011). The standard state value of steam is calculated by grevel and treated as variables in a refine step based on the FORTRAN routine in the NAG FORTRAN-Library (Numerical Algorithm Group Ltd., Oxford). In the first run, the MAP problem was constrained by the same reversal experiment already used by Grevel and Magislan, 2009) and Star Kate (this study) serve as starting values. They were restricted to change within their mentioned uncertainty. Standard entropy was taken from DeKock (1986), with the exception of ± 1% was observed during map analysis. The resulting values are shown in Table 5a, which matches both our thermal data and the humidity bracket. The purified standard entropy, a data variation of ± 1% was observed during map analysis. The resulting values are shown in Table 5a, which matches both our thermal data and the humidity bracket. The purified standard entropy, a data variation of ± 1% was observed during map analysis. The resulting values are shown in Table 5a, which matches both our thermal data and the humidity bracket. the starting value, meaning it is within the error given by the thermal measurement. On the other hand, entropy values have changed significantly. Maximum difference (2.9 J.mol-1 · K-1) starting value starting values have changed significantly. Maximum difference (2.9 J.mol-1 · K-1) starting value starting value 348.1 J.mol-1 · K-1) starting value sta They concluded a good agreement of data with Chou and Seal (2003) on epsitite/hexahydrite reactions, but concluded significant disagreements with the Butterfly and Seal (2007) experiment for hexahydrite reaction provided by Lalemant et al. (1974). In addition, Steiger et al. (2011) presented data of reaction Epsemited to a freaction Epsemite dehydration to starkeet, especially at high temperatures. Furthermore, the data of reaction Epsemited data of reaction Epsemited data of the Butter reaction Epsemited data on the latter reaction Epsemited data of the Butter reaction Epsemited data of the Butterfly and Seal (2007) experiment at a freaction Epsemited data of the Butter reaction Epsemited data of the Butte keyserite +6H2O. In the second run, the measurements of Steiger et al. (2011) announced that they each announced that they each announced that they each announced that they constrained map procedures to obtain brackets that constrained map procedures to obtain brackets that constrained map exceed announced that they each announced that they eac problems. In this run, all starting values, including entropy values, were slightly changed (cf. Table 5b). FIG. 6 showed equilibrium curves calculated according to Eq.4 using purified data for different hydration reactions. In FIG. 6b, a figure constrained by the Chou and Seal (2003, 2007) brackets, and in FIG. 6b, a figure constrained by the Chou and Seal (2003, 2007) brackets, and in FIG. 6b, a figure constrained by Steiger et al. (2011) data is shown. Obviously, (metastable) dehydrated hexa hydrate/star Kate is moved to a higher temperature by Steiger et al. (2011) data is shown. here. The invariant H2O + vapor defined by MgSO4 ·7H2O + MgSO4 ·0 corresponds to the lower limit of the hexa hydrate stability field and is located at about 7.5 ° C. and 39.0% RH (FIG. 6a), respectively, and is 10.0 ° C. and 40.7% RH (FIG. 6a), respectively, and is 10.0 ° C. modeled at 3°C and 32.9% RH (2011) were now found below 0°C. If the MAP problem is constrained by Chou and Seal (2003; 2007) data, this point is located at about -18 °C. and 27.2% RH, and when the data is constrained by Chou and Seal (2007). At -50 °C, epsymite-to-star kite (metastatic) dehydration occurs at about 20% RH, and when the data is constrained by Experiments by Steiger et al. (2011), about -18 °C. is obtained at about -18 °C. is obtained at about 28.3% RH. Quantitatively, both figures are very similar to Figure 6 of butterflies and seals (2007). At -50 °C, epsymite-to-star kite (metastatic) dehydration occurs at about 20% RH, and when the data is constrained by Experiments by Steiger et al. (2011), about -18 °C. is obtained at about 28.3% RH. Quantitatively, both figures are very similar to Figure 6 of butterflies and seals (2007). At -50 °C, epsymite-to-star kite (metastatic) dehydration occurs at about 20% RH, and when the data is constrained by Experiments by Steiger et al. (2011), about -18 °C. is obtained at about 28.3% RH. Quantitatively, both figures are very similar to Figure 6 of butterflies and seals (2007). At -50 °C, epsymite-to-star kite (metastatic) dehydration occurs at about 20% RH, and when the data is constrained by Experiments by Steiger et al. (2001), about -18 °C. is obtained at about 28.3% RH. Quantitatively, both figures are very similar to Figure 6 of butterflies and seals (2007). At -50 °C, epsymite-to-star kite (metastatic) dehydration occurs at about 20% RH. and the epsyte-keycelite reaction is ca. Occurs at 25% RH; this behavior is almost similar in Figures 6a and 6b, slightly different from that of Steiger et al. (2011), which calculates equilibrium humidity at this temperatures, i.e., the overcooled liquid water, based on the pure water standard state at high temperatures to p0. When sublimation pressure, or saturated vapor pressure on ice represented by the ice line of the diagram, is used, the equilibrium humidity calculated at T=-50°C is 21% RH for epsete-star keyate transitions. So there is actually an excellent agreement with the calculation on Mars through at 1007) and Steiger et al. (2011) have already pointed out, magnesium sulfate hydrates may play a dominant role in water circulation on Mars through hydration and dehydration reactions containing atmospheric moisture during the Nikkei cycle of heating and cooling. Meridianite (n=1) are stable phase, the so-called multi hydrated phases, the so-called multi hydrated phases, the so-called multi hydrated sulfates, undoubtedly exist on Mars, but the exact nature of the latter stage has not been known until now. Possible candidates include hydrated sulfates (Roach et al., 2009), which contain not only higher hydrated sulfates, but also other cythione and double compounds such as broedite. Motion limits strong in Mg-sulfate quilibrium can prevent kiselite hydration to kiselite is very low. Thus, star Kate's metastable formation is also possible under Martian conditions. While advantageous from a nodynamic point of view, low temperatures on Mars can slow down reaction speeds that are too short for daily cycling to allow for significant changes in hydrate hydrates in the martian water circulation must be approached with caution due to uncertainty in the reaction path at low temperatures on the Martian surface. In addition further experimental data is needed at subzero temperatures to bracket Mg-sulfate stability. Nevertheless, this study constrains the storage conditions of the metastable four-sided and trihed hydrates of MgSO4, an essential requirement for interpreting possible detection of these species by the mineralogy package of the upcoming Curiosity Mars rover, including in-sed-ray diffring. The study derived two slightly different sets of thermodynamic data internally for several MgSO4, an essential requirement for interpreting possible detection of these species by the mineralogy package of the upcoming Curiosity Mars rover, including in-sed-ray diffring. hydrates by mathematical programming procedure. For starkeyts based on thermal measurements. These sets are based on the brackets provided by Steiger et al. (2011) and on the other hand, butterflies and seals (2003, 2007) (Fig. 1). The deviation from the input value is significantly smaller if the MAP problem is constrained by the scattered Steiger et al. (2011) data than the shoe and seal (2003, 2007) (data. Since the treatment of hexahydrites starkeet equilibrium by Steiger et al. (2011) is also consistent with the solubleness of all two solids (Steiger, personal communication), it is preferable to use the data described in Table 5b. However, both data sets are internally consistent. In order to further constrain the data, lower temperature heat measurement data is necessary. The references van't Hoff et al. (1901) given by Steiger et al. (2011). This work is supported and highly appreciated by the German Forschungsgeminshaft (Grant MA 3927/5-1 and 5-2). We are also grateful for the grant of P23056 to the Austrian Science Fund (FWF), project number P21370 to E. Dax and A. Benicek. DSC, differential scanning thermal measurement, differential scanning thermometer; MAP, mathematical programming; PPMS, physical property measurement system; TG, thermogragranth analysis; XRD, X-ray powder diffring. Ackerman Socience Fund Radzik B. Armblester T. Doyle S. Grevel K-D Majizlan J. Cornelite (Fe2 (SO4) 3 to 7.75 H2O) and Paracoquimbte (Fe2 (SO4) 3.9H2O) Thermodynamics and Crystallological Properties of Am Minerals.2009; 94:1620–1628. [Google Scolor] Isopesis investigation of permeability and activity coefficient of archer D.G. Lard J.A. water-based MgSO4 and solubility of MgSO4.7H2O(cr) 298.15K: Thermodynamic properties of MgSO4+H2O system in 440 K.J Chem Eng data. 1998;43:791– 806. [Google Scolor] Baul W. H. Zulu Crystal Chemmy der Salz hydrate Die Crystal Kutulen von MgSO4.4H2O (Leonhartit) Unto Feso 4. 4H2O (Rosenit) Actor Crystal Loger. 1962;15:815–826. [Google Skolor] On the Crystal lization of Baul W.H. Saltwater Washi. IV. Improvement of Crystal Structure of MgSO4.4H2O (Leonhartit) Unto Feso 4. 4H2O (Rosenit) Actor Crystal Structure of MgSO4 and 4H2O. 1964a;17:863-869 . [Google Skolor] On the Crystal Loger. 1962;15:815–826. [Google Skolor] On the Crystal Structure of MgSO4.4H2O (Leonhartit) Unto Feso 4. 4H2O (Rosenit) Actor Crystal Structure of MgSO4 and 4H2O. 1964a;17:863-869 . [Google Skolor] On the Crystal Structure of MgSO4 and 4H2O. 1964a;17:863-869 . [Google Skolor] On the Crystal Structure of MgSO4.4H2O (Rosenit) Actor Crystal Structure of MgSO4 and 4H2O. 1964a;17:863-869 . [Google Skolor] On the Crystal Structure of MgSO4 and 4H2O. 1964a;17:863-869 . [Google Skolor] On the Crystal Structure of MgSO4 and 4H2O. 1964a;17:863-869 . [Google Skolor] On the Crystal Structure of MgSO4.4H2O (Rosenit) Actor Crystal Structure of MgSO4 and 4H2O. 1964a;17:863-869 . [Google Skolor] On the Crystal Structure of MgSO4.4H2O (Rosenit) Actor Crystal Structure of MgSO4.4H2O (Rosenit) Actor Crystal Structure of MgSO4 and 4H2O. 1964a;17:863-869 . [Google Skolor] On the Crystal Structure of MgSO4.4H2O (Rosenit) Actor Crystal Structure of MgSO4.4H2O (Rosenit) Actor Crystal Structure of MgSO4 and 4H2O. 1964a;17:863-869 . [Google Skolor] On the Crystal Structure of MgSO4.4H2O (Rosenit) Actor Crystal Structure of MgSO4.4H2O (R crystalline. 1964b;17:1361-1369 . [Google Scolour] Baul W. H. Lorin J. L. Salt Hydrate: IX. Comparison of crystal structure of magnesium sulfate pentahydrate. 1972; B28:1448-1455 . [Google Scolour] Baul W. H. Lorin J. L. Salt Hydrate: IX. Comparison of crystal structure of magnesium sulfate pentahydrate. 1972; B28:1448-1455 . [Google Scolour] Baul W. H. Lorin J. L. Salt Hydrate: IX. Comparison of crystal structure of magnesium sulfate pentahydrate. 1972; B28:1448-1455 . [Google Scolour] Baul W. H. Lorin J. L. Salt Hydrate: IX. Comparison of crystal structure of magnesium sulfate pentahydrate. 1972; B28:1448-1455 . [Google Scolour] Baul W. H. Lorin J. L. Salt Hydrate: IX. Comparison of crystal structure of magnesium sulfate pentahydrate. 1972; B28:1448-1455 . [Google Scolour] Baul W. H. Lorin J. L. Salt Hydrate: IX. Comparison of crystal structure of magnesium sulfate pentahydrate. 1972; B28:1448-1455 . [Google Scolour] Baul W. H. Lorin J. L. Salt Hydrate: IX. Comparison of crystal structure of magnesium sulfate pentahydrate. 1972; B28:1448-1455 . [Google Scolour] Baul W. H. Lorin J. L. Salt Hydrate: IX. Comparison of crystal structure of magnesium sulfate pentahydrate. 1972; B28:1448-1455 . [Google Scolor] Baul W. H. Lorin J. L. Salt Hydrate: IX. Comparison of crystal structure of magnesium sulfate pentahydrate. 1972; B28:1448-1455 . [Google Scolor] Baul W. H. Lorin J. L. Salt Hydrate: IX. Comparison of crystal structure of magnesium sulfate pentahydrate. 1972; B28:1448-1455 . [Google Scolor] Baul W. H. Lorin J. L. Salt Hydrate: IX. Comparison of crystal structure of magnesium sulfate pentahydrate. 1972; B28:1448-1455 . [Google Scolor] Baul W. H. Lorin J. L. Salt Hydrate: IX. Comparison of crystal structure of magnesium sulfate pentahydrate. 1972; B28:1448-1455 . [Google Scolor] Baul W. H. Lorin J. L. Salt Hydrate: IX. Comparison of crystal structure of magnesium sulfate pentahydrate. 1972; B28:1448-1455 . [Google Scolor] Baul W. H. Lorin J. L. Salt Hydrate: IX. Comparison of crystal structure of magnesium sulf Chatterjee N.D. Applied Mineralogy Thermodynamics - Selected Topics. Springer Velarg; Berlin: 1991. [Google S collar] Chiterra S.J. Baniman D.T. Experimental stability of magnesium sulfate hydrate that may be present on Mars. Geochim Cosmosim Actor 2007; 71:241–250. [Google Scolor] Butterfly I.-M. Seal R.R., II E evaporation, water, life, partial I. 0.1 Mpa humidity buffering technology determines epsitite-hexa hydrate equilibrium affects the phase equilibrium of system MgSO4-H2O. Astrobiology. 2003;3:619–630. [Pubmed] [Google Sklor] Chow I.-M.Seal R.R., II Magnesium and Calcium Sulfate Stability and Mars Water Budget. J The Office Res. 2007;112 doi: 10.1029/2007JE002898. Cross-Ref [Google Scolor] Cox W.P. Honun E.W. Jawk W.F. Spontaneous conversion from macrocrystalline stage to microcrystalline phase at low temperatures. Thermal capacity of MgSO4 and 6H2O. J Am Kem Sock 1955;77:3935-3938 . [GoogleS color] Dax E. Benisek A. Sample saving method for measurement. Cryogenic. 2011;51:460–464. [PMC Free Article] [Pubmed] [Google Scolour] Dax E. Benisek A. Sample saving method for measurement. Cryogenic. 2011;51:460–464. [PMC Free Article] [Pubmed] [Google Scolour] Dax E. Benisek A. Sample saving method for measurement. Cryogenic. 2011;51:460–464. [PMC Free Article] [Pubmed] [Google Scolour] Dax E. Benisek A. Sample saving method for measurement. Cryogenic. 2011;51:460–464. [PMC Free Article] [Pubmed] [Coogle Scolour] Dax E. Benisek A. Sample saving method for measurement. Cryogenic. 2011;51:460–464. [PMC Free Article] [Pubmed] [Coogle Scolour] Dax E. Benisek A. Sample saving method for measurement. Cryogenic. 2011;51:460–464. [PMC Free Article] [Pubmed] [Coogle Scolour] Dax E. Benisek A. Sample saving method for measurement. Cryogenic. 2011;51:460–464. [PMC Free Article] [Pubmed] [Coogle Scolour] Dax E. Benisek A. Sample saving method for measurement. Cryogenic. 2011;51:460–464. [PMC Free Article] [Pubmed] [Coogle Scolour] Dax E. Benisek A. Sample saving method for measurement. Cryogenic. 2011;51:460–464. [PMC Free Article] [Pubmed] [Coogle Scolour] Dax E. Benisek A. Sample saving method for measurement. Cryogenic. 2011;51:460–464. [PMC Free Article] [Pubmed] [Coogle Scolour] Dax E. Benisek A. Sample saving method for measurement. Cryogenic. 2011;51:460–464. [PMC Free Article] [Pubmed] [Coogle Scolour] Dax E. Benisek A. Sample saving method for measurement. Cryogenic. 2011;51:460–464. [PMC Free Article] [Pubmed] [Coogle Scolour] Dax E. Benisek A. Sample saving method for measurement. Cryogenic. 2011;51:460–464. [PMC Free Article] [Pubmed] [Coogle Scolour] Dax E. Benisek A. Sample saving method for measurement. Cryogenic. 2011;51:460–464. [PMC Free Article] [Pubmed] [Coogle Scolour] Dax E. Benisek A. Sample saving method for measurement. technology: Low temperature heat capacity of milligram-sized synthetic mineral samples. European Journal of Mineralogy.2005;17:251–261. [Google Scolor] Dax E. Harlov D. Benisek A. Excessive heat capacity of Mineralogy.2005;17:251–261. [Google Scolor] Dax E. Harlov D. Benisek A. Excessive heat capacity and entropy mixed along fluorine chlorapaate binomial bonds. Physics and Chemistry of Mineralogy.2005;17:251–261. [Google Scolor] Dax E. Harlov D. Benisek A. Excessive heat capacity of Mineralogy.2005;17:251–261. [Google Scolor] Dax E. Harlov D. Benisek A. Excessive heat capacity and entropy mixed along fluorine chlorapaate binomial bonds. Physics and Chemistry of Mineralogy.2005;17:251–261. [Google Scolor] Dax E. Harlov D. Benisek A. Excessive heat capacity and entropy mixed along fluorine chlorapaate binomial bonds. Physics and Chemistry of Mineralogy.2005;17:251–261. [Google Scolor] Dax E. Harlov D. Benisek A. Excessive heat capacity and entropy mixed along fluorine chlorapaate binomial bonds. Physics and Chemistry of Mineralogy.2005;17:251–261. [Google Scolor] Dax E. Harlov D. Benisek A. Excessive heat capacity and entropy mixed along fluorine chlorapaate binomial bonds. Physics and Chemistry of Mineralogy.2005;17:251–261. [Google Scolor] Dax E. Harlov D. Benisek A. Excessive heat capacity and entropy mixed along fluorine chlorapaate binomial bonds. Physics and Chemistry of Mineralogy.2005;17:251–261. [Google Scolor] Dax E. Harlov D. Benisek A. Excessive heat capacity and entropy mixed along fluorine chlorapaate binomial bonds. Physics and Chemistry of Mineralogy.2005;17:251–261. [Google Scolor] Dax E. Harlov D. Benisek A. Excessive heat capacity and entropy mixed along fluorine chlorapate binomial bonds. Physics and Chemistry of Mineralogy.2005;17:251–261. [Google Scolor] Dax E Japan] 1984;92:153-155. [Google Scolor] DeCock C.W. Information Circular 9081. U.S. Department of the Interior's Bureau of Mines; Washington, D.C.: 1986. Thermodynamic properties of selected metal sulfates and their hydrates. [Google Scolor] Ditomars D.A. Ishihara S.Chang S.Bernstein G.West E.D. Enthalpy and Heat Capacity Standard Standard Material - Synthetic Sapphire (α -Al2O3) 10-2250 K.J Lesnatre Bar Stand. 1982;87:159–163. [Google Scolor] Ferrari G. Jones D. A. Ishihara S.Chang S.Bernstein G.West E.D. Enthalpy and Heat Capacity Standard Standard Material - Synthetic Sapphire (α -Al2O3) 10-2250 K.J Lesnatre Bar Stand. 1982;87:159–163. [Google Scolor] Decock C.W. Information Circular 9081. U.S. Department of the Interior's Bureau of Mines; Washington, D.C.: 1986. Thermodynamic properties of selected metal sulfates and their hydrates. [Google Scolor] Decock C.W. Information Circular 9081. U.S. Department of the Interior's Bureau of Mines; Washington, D.C.: 1986. Thermodynamic properties of selected metal sulfates and their hydrates. [Google Scolor] Decock C.W. Information Circular 9081. U.S. Department of the Interior's Bureau of Mines; Washington, D.C.: 1986. Thermodynamic properties of selected metal sulfates and their hydrates. [Google Scolor] Decock C.W. Information Circular 9081. U.S. Department of the Interior's Bureau of Mines; Washington, D.C.: 1986. Thermodynamic properties of selected metal sulfates and their hydrates. [Google Scolor] Decock C.W. Information Circular 9081. U.S. Department of the Interior's Bureau of Mines; Washington, D.C.: 1986. Thermodynamic properties of selected metal sulfates and their hydrates and thei W. Yarkes J. Improvement of crystal structure of magnesium sulfate heptahydrate (epsepmite) by neutron diffrestion. Dalton Trance 1973; 8:816-821. [Google Scolor] Fortes A.D. Leme-Cayot M.H. Institut Lau Langevin; Grenoble, France: 2010. Structural system of MgSO4 nD2O (n=11/4, 2, 21/2, 3, 4, 5) using neutron single crystal diffring. Experimental report number 5-11-360. [Google Thermoelastic properties of Epsepmite) by neutron diffrestion. Dalton Trance 1973; 8:816-821. [Google Scolor] Fortes A.D. Leme-Cayot M.H. Institut Lau Langevin; Grenoble, France: 2010. Structural system of MgSO4 nD2O (n=11/4, 2, 21/2, 3, 4, 5) using neutron single crystal diffring. Experimental report number 5-11-360. [Google Thermoelastic properties of Epsepmite] by neutron single crystal diffring. Experimental report number 5-11-360. [Google Thermoelastic properties of Epsepmite] by neutron single crystal diffring. Experimental report number 5-11-360. [Google Thermoelastic properties of Epsepmite] by neutron single crystal diffring. Experimental report number 5-11-360. [Google Thermoelastic properties of Epsepmite] by neutron single crystal diffring. Experimental report number 5-11-360. [Google Thermoelastic properties of Epsepmite] by neutron single crystal diffring. Experimental report number 5-11-360. [Google Thermoelastic properties of Epsepmite] by neutron single crystal difference in the term of the term of the term of term o Alfredson M. Vochadro L. Powder neutron diffring and ab inycio simulation. European Journal of Mineralogy.2006;18:449–462. [Google Scolor] Fortes A.D. Wood I.G. Nočadlo L. Brand H.E.A. Knight K.S. Study of magnesium sulfate multicolorium anhydrous. I: Structure of α -MgSO4 and thermal expansion J Apel crystal llole. 2007;40:761–770. [Google Sklor] Fortes A.D. Wood I.G. Night K.S. Crystal structure of α -MgSO4 and thermal expansion J Apel crystal llole. 2007;40:761–770. [Google Sklor] Fortes A.D. Wood I.G. Night K.S. Crystal structure and thermal expansion tensor of MgSO4 11D2O (meridion) as required by neutron powder diffrestion. Physics and Chemistry of the International Mineralogical Society at IMA 2010. August 21-27, 2010 Budapest, Hungary: Actaminerarozica - in Petroographic. 2010. Abstract Nineral of the International Mineralogical Society at IMA 2010. August 21-27, 2010 Budapest, Hungary: Actaminerarozica - in Petroographic. 2010. Abstract Series, Seged, 6:705. [Google S collar] Frost G.B Breck W.G. Clayton R.N. Red Dutch A.H. Miller C.G. Magnesium sulfate hydrate crystals and thermal capacity in vacuum dehydration form. J Chem. 1957; 35:1446-1453. [Google Scolor] Grevel K.-D. Chatterjee Performs the state equation of the N.D.H2-H2O fluid mixture at high pressure and at a temperature of 400 ° C. or higher. European Journal of Mineralogy.1992;4:1303–1310. [Google Scolor] Grevel K.-D. Zaizran J. Internal consistent thermodynamic data of magnesium sulfate hydrates. Geochim Cosmosim Actor 2009; 73:6805–6815. [Google S collar] Grindrod P.M. Heap M.J. Fortes A.D. Meredith P.G. Wood I.G. Tripetta F. Sammons P.R. Experimental investigation of the mechanical properties of synthetic magnesium sulfate hydrates. Kem Gior 2011; 286:301-306. [Google S collar] Grindrod P.M. Heap M.J. Fortes A.D. Meredith P.G. Wood I.G. Tripetta F. Sammons P.R. Experimental investigation of the mechanical properties of synthetic magnesium sulfate hydrates. Kem Gior 2011; 286:301-306. [Google S collar] Grindrod P.M. Heap M.J. Fortes A.D. Meredith P.G. Wood I.G. Tripetta F. Sammons P.R. Experimental investigation of the mechanical properties of synthetic magnesium sulfate hydrates. Kem Gior 2011; 286:301-306. [Google S collar] Grindrod P.M. Heap M.J. Fortes A.D. Meredith P.G. Wood I.G. Tripetta F. Sammons P.R. Experimental investigation of the mechanical properties of synthetic magnesium sulfate hydrates. Kem Gior 2011; 286:301-306. [Google S collar] Grindrod P.M. Heap M.J. Fortes A.D. Meredith P.G. Wood I.G. Tripetta F. Sammons P.R. Experimental investigation of the mechanical properties of synthetic magnesium sulfate hydrates. Kem Gior 2011; 286:301-306. [Google S collar] Grindrod P.M. Heap M.J. Fortes A.D. Meredith P.G. Wood I.G. Tripetta F. Sammons P.R. Experimental investigation of the mechanical properties of synthetic magnesium sulfate hydrates. Kem Gior 2009; 73:6805–6815. [Google S collar] Grindrod P.M. Heap M.J. Fortes A.D. Meredith P.G. Wood I.G. Tripetta F. Sammons P.R. Experimental investigation of the mechanical properties of synthetic magnesium sulfate hydrates. Kem Gior 2009; 73:6805–6815. [Google S collar] Grindrod P.M. Heap M.J. Fortes A.D. Meredith P.G. Wood I.G. Tripetta F. Sammons P.R. Experimental investigation of the mechanical properties of synthetic magnesium sulfate hydrates. Kem Gior 2009; 73:6805–6815. [Google S collar] Grindrod P.M. Experimental properties of synthetic magnesium sul hydrates: effects on the strength of hydrate deposits on Mars. J Ji Office Res. 2010;115 doi: 10.1029/2009JE003552. Cross-Ref [Google Scolor] Haar L. Gallagher J.S. Kell G.S. Computer program for water vapor and liquid status in SI units with thermodynamics and transport for water vapor and transport. Character J.S. Kell G.S. Computer program for water vapor and liquid status in SI units with thermodynamics and transport. properties. Hemispheric Publishers; Washington, D.C.: 1984. NBS/NRC steam table. [Google Skolor] Hawthorne F.C Groat L.A. Loudsep M. Elsit T.S. Keyserite, Mg(SO4)-H2O, a titanium acid group mineral. Neue Yabhu für Mineralology Áckermanngen 1987; 157:121–132. [Google Skolor] von Hodenberg R. Kyun R. Zulu Kentonis der Magnesium Sulfat hydrate und der Efloreszenzen de Kieselitz von Harzalzenkari und Steinsalz[Google Skolor] How thorne F.C Groat L.A. Loudsep M. Elsit T.S. Keyserite, Mg(SO4)-H2O, a titanium acid group mineral. Neue Yabhu für Mineralology Áckermanngen 1987; 157:121–132. [Google Skolor] too H.C G.E. Investigating Report 8409. U.S. Department of the Interior Department of the Interior Department of Mines; Washington, D.C.: 1979. α and β - Enthalpy in the formation of magnesium sulfate hydrate. [Google Scolor] Lalemant M. Wattel G. Boionon B. Rieviere M. Cohen-Adad R. Contribution A Letude du System Binaire MgSO4-H2O: The Success of Tension de Vapur de Solur] Rushley J. C Hundley M.F. Miglioli A. Sarao J. L. Pagliuso P.G. Darling T.W. Jamie M. Cooley J.C. Harz W. L. Morales L. Toma D.J. Smith J.L. Borio Goats J. Woodfield B.F. Stewart G.R. Fisher R.A. Phillips N.E. 2003;43:369–378. [Google Scolour] Linke W.F. 4th Volume 2 American Chemical Society; Washington, D.C.: 1965. Solubility — Collection of solubility data from periodic literature of inorganic compounds and metal organic compounds [Google Skolor] Ma H. Bish D.L. One H.-W. Sipera S.J. Determining the crystal structure of sanderite, MgSO4.2H2O, is a mineral by X-ray powder diffring and charge reversal. 2009b;94:1071-1074. [Google Sklor] Thermal dynamics of the Pavan R.T. Pitzer K.S. concentrated electrolyte mixture and prediction of mineral solubleness of the mixture in the Na-K-Mg-Cl-SO4-OH-H2O system for high temperatures. Geochim Cosmosim Actor 1987; 51:2429-2443. [Google S collar] Parker V.B. Thermal properties of univalent electrolytes. National Standard Reference Data Series, National Bureau; Washington, D.C.: 1965. [Google S collar] Peterson R.C. Cranswicke MgSO4.4H2O, a new mineral from the expansion and contraction of Argentina. Minerals. 2011;96:869-877. [Google S collar] Peterson R.C. Cranswicke MgSO4.4H2O, a new mineral from the expansion and contraction of Argentina. Minerals. 2011;96:869-877. [Google S collar] Peterson R.C Wan R. Crystal molds on Mars: melting of new mineral species possible to create the chaotic terrain of Mars. Geological. 2006;34:957–960. [Google Scolour] Lentze peris P.J. Soldateus C.T. Crystal structure of magnesium anhydrous sulfate. Akhtar Crystal structure of magnes structure of magnes structure of magnes structure Scolor] Roach L.H. Mustard J.F. Murchie S.L. Vibrating J.-P.F. Lewis K.W. Aharonson O. Vincendon M. Bishop J.L. forgets to test evidence of recent changes in the hydration status of sulfates on Mars. J Ji Office Res. 2009;114 doi: 10.1029/2008JE003245. Cross-Ref [Google Sklor] Lobby R.A. Hemingway B.S. Hydrodynamic Properties and Association of Minerals298.15 K and 1 bar (105 pascals) and at high temperatures. U.S. Geological Survey Bulletin 2131, U.S. Government Printing Office; Washington, D.C.: 1995. [Google Scolour] Lowe J.J. Moray G.W. Silver C . C Teral K2SO4-MgSO4-CaSO4. Journal of Inorganic and Nuclear Chemistry 1967;29:925–942. [Google Scolour] Lowe J.J. Moray G.W. Silver C . C Teral K2SO4-MgSO4-CaSO4. Journal of Inorganic and Nuclear Chemistry 1967;29:925–942. [Google Scolour] Lowe J.J. Moray G.W. Silver C . C Teral K2SO4-MgSO4-CaSO4. Journal of Inorganic and Nuclear Chemistry 1967;29:925–942. [Google Scolour] Lowe J.J. Moray G.W. Silver C . C Teral K2SO4-MgSO4-CaSO4. Journal of Inorganic and Nuclear Chemistry 1967;29:925–942. [Google Scolour] Lowe J.J. Moray G.W. Silver C . C Teral K2SO4-MgSO4-CaSO4. Journal of Inorganic and Nuclear Chemistry 1967;29:925–942. [Google Scolour] Lowe J.J. Moray G.W. Silver C . C Teral K2SO4-MgSO4-CaSO4. Journal of Inorganic and Nuclear Chemistry 1967;29:925–942. [Google Scolour] Lowe J.J. Moray G.W. Silver C . C Teral K2SO4-MgSO4-CaSO4. Journal of Inorganic and Nuclear Chemistry 1967;29:925–942. [Google Scolour] Lowe J.J. Moray G.W. Silver C . C Teral K2SO4-MgSO4-CaSO4. Journal of Inorganic and Nuclear Chemistry 1967;29:925–942. [Google Scolour] Lowe J.J. Moray G.W. Silver C . C Teral K2SO4-MgSO4-CaSO4. Journal of Inorganic and Nuclear Chemistry 1967;29:925–942. [Google Scolour] Lowe J.J. Moray G.W. Silver C . C Teral K2SO4-MgSO4-CaSO4. Journal of Inorganic and Nuclear Chemistry 1967;29:925–942. [Google Scolour] Lowe J.J. Moray G.W. Silver C . C Teral K2SO4-MgSO4-CaSO4. Journal of Inorganic and Nuclear Chemistry 1967;29:925–942. [Google Scolour] Lowe J.J. Moray G.W. Silver C . C Teral K2SO4-MgSO4-MgSO4-CaSO4. Journal of Inorganic and Nuclear Chemistry 1967;29:925–942. [Google Scolour] Lowe J.J. Moray G.W. Silver C . C Teral K2SO4-MgSO4-MgSO4-MgSO4-MgSO4-MgSO4-MgSO4-MgSO4-MgSO4-MgSO4-MgSO4-MgSO4-Mg [Google Scolour] Vaniman D.T. Chiterra S.J. conversion of Mg and Ca sulfate hydrates in Mars regys. Minerals. 2006;91:1628–1642. [Google Scolor] Van Hof J. H. Dawson H.M Unterstungen Uber Die Bildungswernisse der Ouseanischen Salzabragerngen, Insvezondere de Stasfulter Salzlagers: XII. Das Magnesium Sulfathovün fünbiathellatschitzsvel prous acad wis Berlin 1899; 1899:340–343. [Google Scolor] Van Hof J. H. Meyerhofer W. Smith N. Unterstungen Uber Die Bildungswerhertonise der Ozeanischen Salzabragerngen Insvesondele de Stasfulter Saltzlaggers: XXIII. das Auftreten fon Keaselit by 25°C Situngsbel Prous Akad Wis Berlin 1901; 1901:1034–1044. [Google Scolor] Van van Don't Hof J. H. Meyerhofer W Dance J. Armstrong E.F. Balshall H. Biach O. Blasdale W.C Bruni G. Chiaravilio D. Cottrell F. G. Dawson H.M Denison R.B Donan F. Estricher Falp F. Grassi N. Hinrissen W. Just G. Kasatkin N. Kenrick F.B Liechtenstein L. Sachs H. Sanders A.P. Smith N. Bowman G. L. Weigert F. Williams P. Wilson H. Unterstungen Uber Die Bildungsvertonise der Ozenishen Salzabragerngen Insbesondere de Stasfulter Saltzlagers: Precht H, Editor; Cohen E., Editor. Accadémish Beragsgeselshaft m.b.H.; Leipzig: 1912. [Google Sklor] Wagman D.D. Evans W.H. Parker V.B. Shum R.H. Harrow I Bailey S.M. Charney K.L. Nutall R.L. Sapple 2. Volume 11 American Chemical Society and National Bureau of Standards National Institute of Physics; Washington, DC: 1982. NBS table of chemical thermodynamic properties: Journal of inorganic and C1 and C2 organic substance selection values, physical and chemical Reference Data. 1994;23:515–527. [Google S collar] Yamaguchi A. Kato E. [Thermal effect of magnesium anhydrous] in Japanese. Kyokai Yojo [Journal of the Ceramic Society of Japan] 1972;80:337-339. [Google Skolor] Crystal structure and hydrogen bond of Zarkin A. Reuben H. Templeton D.H. magnesium sulfate hexa hydrate. Akhtar Crystal. 1964;17:235-240. [GoogleAstrobiology offers courtesy of Mary Ann Liebert Co., Ltd.

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