Supporting Information for

Experimental Study on Isobaric Molar Heat Capacities of Deep Eutectic Solvent: Choline Chloride + Ethylene Glycol

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S1. The detail of calorimeter

Figure S1 shows the structure of calorimeter (experimental cell) used in this work. The calorimeter is comprised of a tube, a micro heater, two copper blocks, two platinum resistant thermometers and a vacuum cylinder. The micro heater is used to give a temperature increment of fluid when it passes through. The power of the heater is provided and controlled by a current power supply (ITECH IT6333A) to maintain a temperature increment of about 3 K. Two thermometers are inserted into the copper blocks to measure the temperatures of fluid before and after heating. The temperatures and electrical power data are transmitted to the multimeter (Keithley 2002) and recorded by the computer. The vacuum cylinder is used for supporting the tube and eliminating the convection heat loss of micro heater. Two copper blocks and the micro heater are covered by the thermal insulation materials to reduce the radiation heat transfer of them.

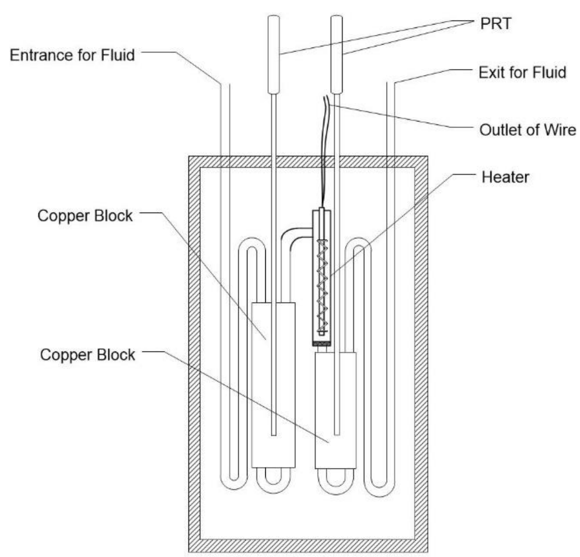

Figure S1. Sketch of the calorimeter

S2. The assessment of uncertainty

Table S1 lists the experimental uncertainties of temperature, pressure, power of heater and heat capacity, and the expended uncertainties in the measurement can be given by [1]:

$$U = k \cdot u_{\mathrm{c}} \tag{S1}$$

in which k represents the confidence coefficient and u_{c} is standard uncertainty. For the expanded uncertainties of temperature, pressure and power of heater, the u_{c} can be calculated as follow:

$$U = k\sqrt{\sum u_i^2} \tag{S2}$$

where u_i is the uncertainty of each influencing factor in Table S1.

Measurement uncertainty of heat capacity is associated with uncertainties of the measured quantities, which are temperature, pressure and power of heater in this work. Thus the relative expanded uncertainty of isobaric heat capacity in the measurement is decided by:

$$U_{c_p} = \frac{k}{c_p}\sqrt{\left(\frac{\partial c_p}{\partial \Delta T}\right)^2 u_{\Delta T}^2 + \left(\frac{\partial c_p}{\partial q_m}\right)^2 u_{q_m}^2 + \left(\frac{\partial c_p}{\partial P}\right)^2 u_P^2} \tag{S3}$$

where $u_{\Delta T}$, u_{qm} and u_P are standard uncertainties of ΔT, q_m and P, respectively. For the confidence coefficient of 2 at 95% degree of confidence, the expanded uncertainties of temperature, pressure and isobaric heat capacity in this work are estimated to be 0.02 K, 5.0 kPa and 1.28%, respectively

Table S1. Experimental uncertainties of temperature, pressure, power of heater and heat capacity.

	Factor of uncertainty	**uncertainty**
Temperature	Platinum resistance thermometer u_1	±0.01 K
	Data collection u_2	±0.01 ppm
	Resistance of standard resistance u_3	±20 ppm
	Combined standard uncertainty u_{c}	±0.01 K
Pressure	Pressure transmitter u_1	±2.5 kPa
	Data collection u_2	±0.01 ppm
	Resistance of standard resistance u_3	±20 ppm
	Combined standard uncertainty u_{c}	±2.5 kPa

	Factor of uncertainty	uncertainty
Power of heater	Voltage of standard resistance u_1	±1 mV
	Voltage of heater u_2	±1 mV
	Resistance of standard resistance u_3	±20 ppm
	Combined standard uncertainty u_c	±0.0001 W
Isobaric heat capacity	Mass flow u_{qm}	±0.00014 g·s^{-1}
	The temperature difference u_T	±0.01 K
	Power of heater u_P	±0.0001 W
	Relative combined standard uncertainty u_c	±0.64%

The two components of DESs were weighted using an analytical balance (Sartorius BSA4202S) with an uncertainty of 0.01 g, and the molar fraction of ethylene glycol can be decided by:

$$x_1 = \frac{m_1 M_2}{m_1 M_2 + m_2 M_1} \tag{S4}$$

where m_1 and m_2 are weights of ethylene glycol and choline chloride, respectively, M_1 and M_2 are molar masses of two components. Then the expanded uncertainty of molar fraction can be given by:

$$U_x = k \cdot u_c = k\sqrt{\left(\frac{\partial x_1}{\partial m_1}\right)^2 u_{m_1}^2 + \left(\frac{\partial x_1}{\partial m_2}\right)^2 u_{m_2}^2} \tag{S5}$$

where u_m is the uncertainty of weighing. At 95% degree of confidence, the expanded uncertainty of molar fraction in this work is finally decided to be lower than 1.4×10^{-4}.

Reference

[1] Taylor, B. N.; Kuyatt, C. E. Guidelines for evaluating and expressing the uncertainty of NIST measurement results. **1994**.