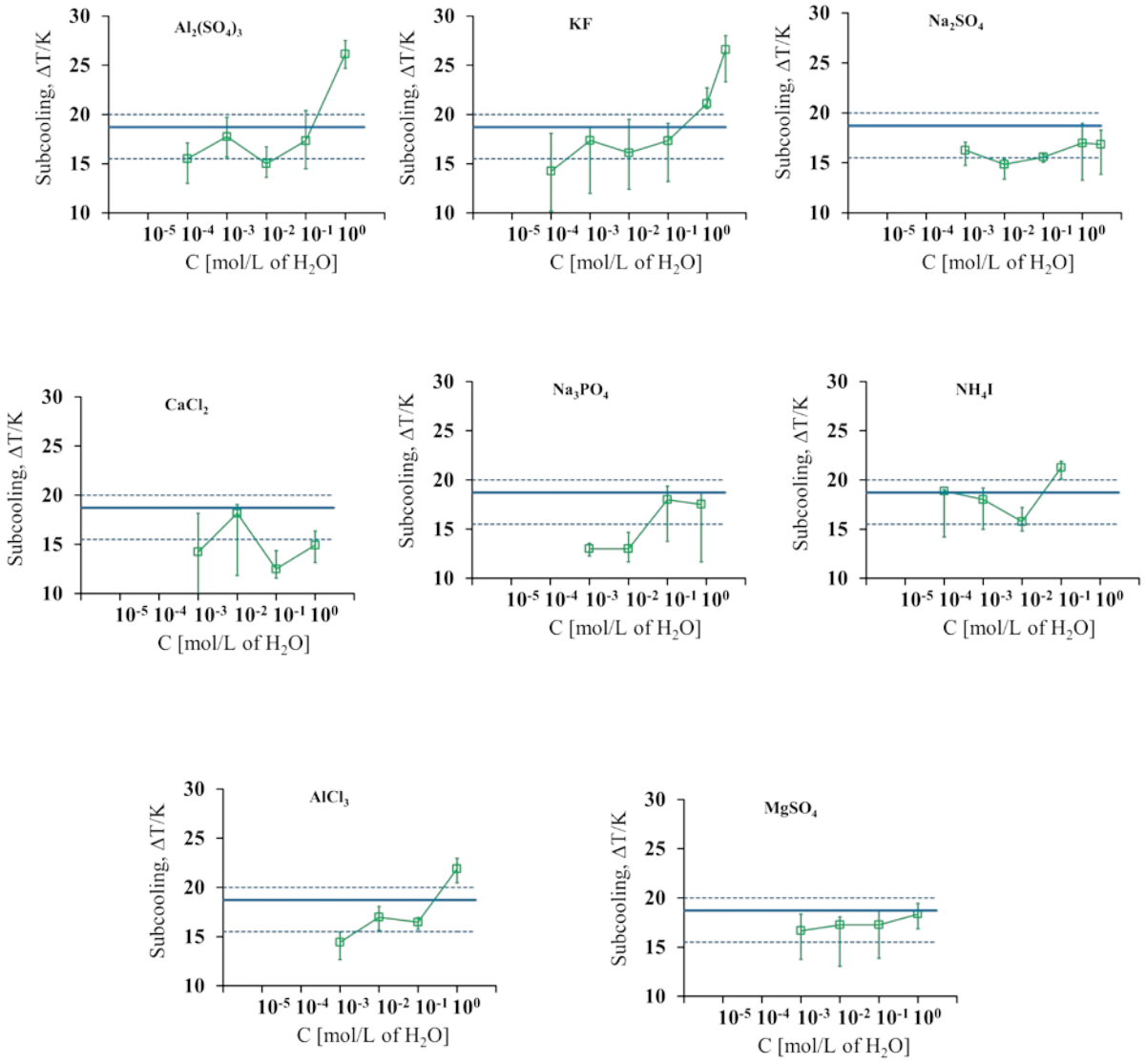
Nucleation Probability Distributions of Methane-Propane Mixed Gas Hydrates in Salt Solutions and Urea

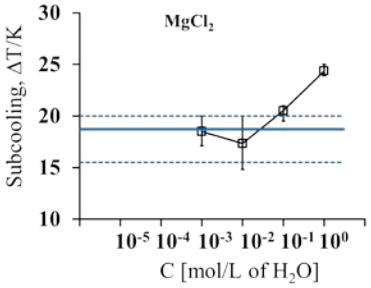
Barbara Sowa [a,b], Xue Hua Zhang [c], Karen A. Kozielski [d], Patrick G. Hartley [a], Dave E. Dunstan [b], Nobuo Maeda [a*]

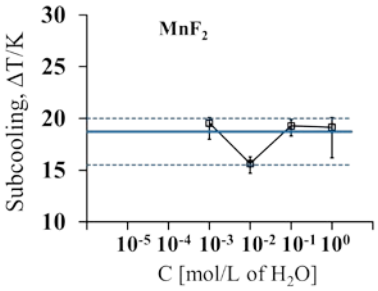
Supplementary Materials

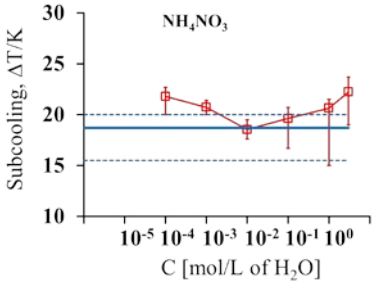
Figure S1

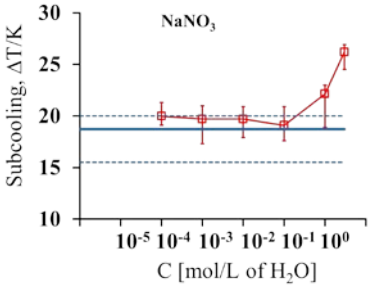
The **THF model hydrate** temperature formation distributions, T_f (subcooling, ΔT /K) as a function of concentration of studied additives at 0.1MPa. The ΔT of THF hydrates in pure water represents the baseline (the blue solid line = ΔT; the dashed lines ="error bars" of pure water). The "stochasticity" and the full width of experimentally measured distribution are represented by "error bars".

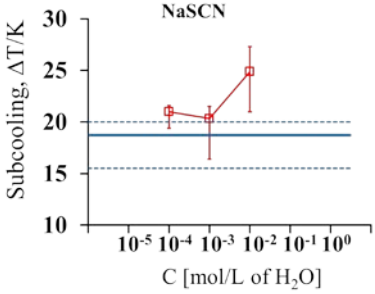


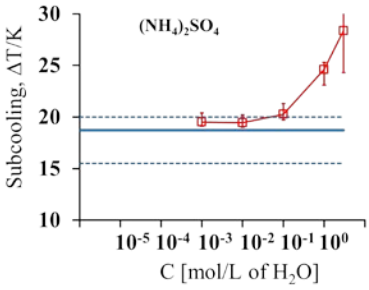

MgCl2
Subcooling, ΔT/K
30
25
20
15
10
10-5 10-4 10-3 10-2 10-1 100
C [mol/L of H2O]

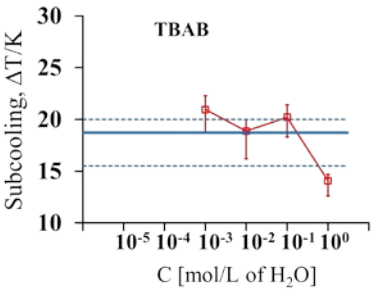

MnF2
Subcooling, ΔT/K
30
25
20
15
10
10-5 10-4 10-3 10-2 10-1 100
C [mol/L of H2O]


NH4NO3
Subcooling, ΔT/K
30
25
20
15
10
10-5 10-4 10-3 10-2 10-1 100
C [mol/L of H2O]


NaNO3
Subcooling, ΔT/K
30
25
20
15
10
10-5 10-4 10-3 10-2 10-1 100
C [mol/L of H2O]


NaSCN
Subcooling, ΔT/K
30
25
20
15
10
10-5 10-4 10-3 10-2 10-1 100
C [mol/L of H2O]


(NH4)2SO4
Subcooling, ΔT/K
30
25
20
15
10
10-5 10-4 10-3 10-2 10-1 100
C [mol/L of H2O]


TBAB
Subcooling, ΔT/K
30
25
20
15
10
10-5 10-4 10-3 10-2 10-1 100
C [mol/L of H2O]

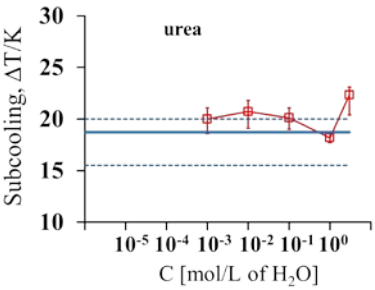
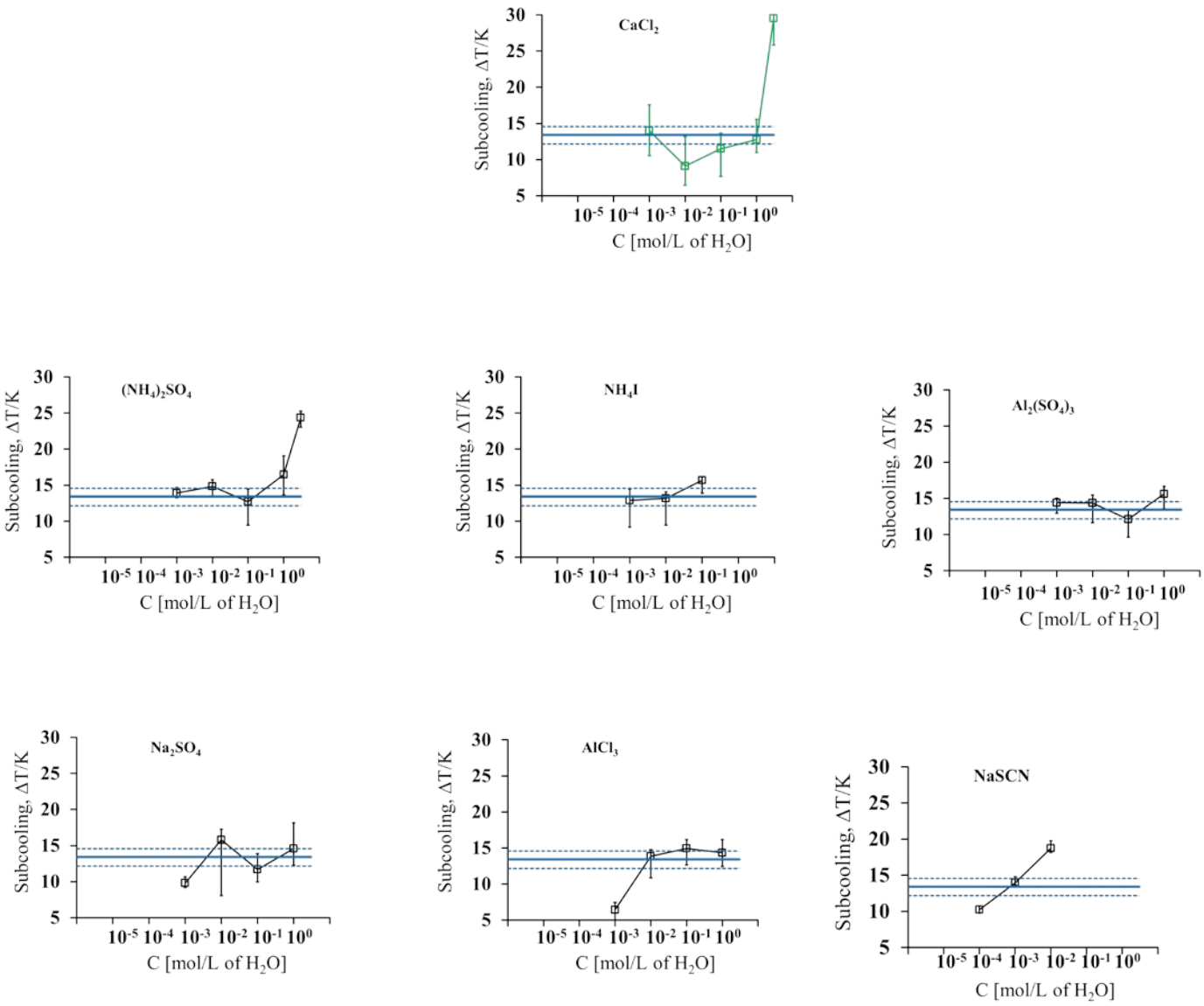
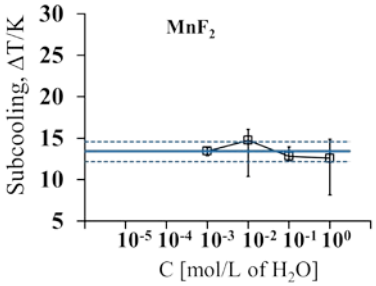
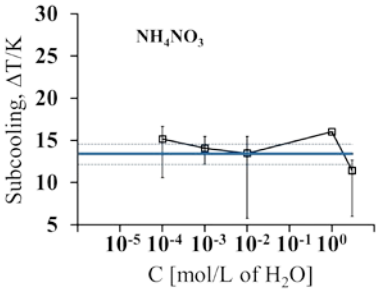

urea
Subcooling, ΔT/K
30
25
20
15
10
10-5 10-4 10-3 10-2 10-1 100
C [mol/L of H2O]

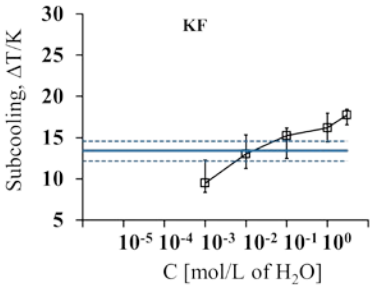
Figure S2

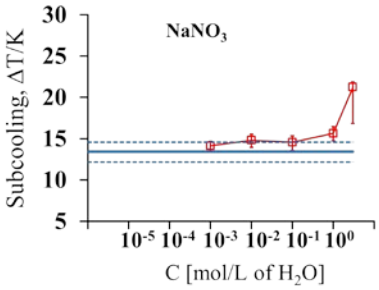
The **ice** temperature formation distributions T_f (Subcooling, ΔT /K) as a function of concentration of studied additives at 0.1MPa. The ΔT of ice from pure water represents the baseline (the blue solid line = ΔT; the dashed lines ="error bars" of pure water). The "stochasticity" and the full width of experimentally measured distribution are represented by "error bars".

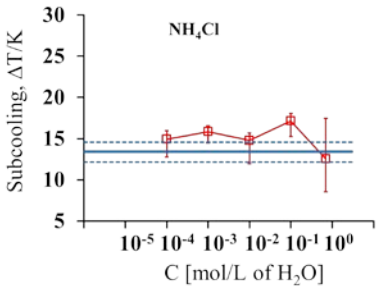



MnF2
Subcooling, ΔT/K
30
25
20
15
10
5
10-5 10-4 10-3 10-2 10-1 100
C [mol/L of H2O]


NH4NO3
Subcooling, ΔT/K
30
25
20
15
10
5
10-5 10-4 10-3 10-2 10-1 100
C [mol/L of H2O]


KF
Subcooling, ΔT/K
30
25
20
15
10
5
10-5 10-4 10-3 10-2 10-1 100
C [mol/L of H2O]


NaNO3
Subcooling, ΔT/K
30
25
20
15
10
5
10-5 10-4 10-3 10-2 10-1 100
C [mol/L of H2O]


NH4Cl
Subcooling, ΔT/K
30
25
20
15
10
5
10-5 10-4 10-3 10-2 10-1 100
C [mol/L of H2O]