Figure 12-3: Excess enthalpy of ethanol(1)-water(2) solutions (from Ott et al., *J. Chem. Thermodynamics*, **18**[1986], pp. 867–875).

Example 12.3: Isothermal and Adiabatic Mixing
Determine the amount of heat exchanged with the surroundings when 0.2 mol of ethanol is mixed isothermally with 0.8 mol of water at 323.15 K. If both pure components are initially at 323.15 K and mixing is adiabatic, what is the temperature of the solution?

Solution *Isothermal mixing.* For isothermal mixing, the amount of heat is equal to the excess enthalpy of mixing. From Figure 12-3, the excess enthalpy at 323.15 K, $x_{\text{ethanol}} = 0.2$ is

$$Q = H^{\text{E}} = -403 \text{ kJ/mol}.$$

Therefore, the solution absorbs −403 kJ/mol of heat.

Adiabatic mixing. If mixing is adiabatic, the energy balance reads

$$Q = 0 = \Delta H,$$

transfers to the bath 403 kJ/mol of heat.