Revisiting "Regular Solutions".

David S. Newman and D.Y. Chen

Department of Chemistry Bowling Green State University Bowling Green, OH 43403 <u>dnewman@bgnet.bgsu.edu</u> Xiangqun Zeng

Department of Chemistry Oakland University Rochester, MI 48309 zeng@oakland.edu

Rex Ren Department of Chemistry Wesleyan University Middletown, CN 06459

LONG ABSTRACT

Many years ago, Joel Hildebrand introduced the concept of "regular solutions" to describe solutions in which the excess molar entropy of mixing, $S_{m}^{E} = 0$, but H^{E}_{m} and V^{E}_{m} , etc., were not equal to zero (1). This required the solutions' entropy to be essentially the same as that of an ideal gas mixture at the same temperature and pressure. In other words, the molecules or ions were distributed randomly, but interacted with each other strongly, but nonrandomly. This concept, along with its associated "solubility parameter" theory, turned out to be almost completely useless as a quantitative predictor of solution behavior except for iodine in several nonpolar solvents, but it did serve from time to time as a model to qualitatively explain deviations from ideality in binary liquid mixtures. We revisit this concept and suggest that the ionic liquids NaAlCl₄, (2), 1-butyl-3methylimidazoliumBF4, 1-hexyl-3-methylpyridiniumPF6, and 1,3 dibutylimidazoliumPF₆, as well as many other similar ionic liquids, may form regular solutions. For these solutions, a useful energy of interaction parameter, *w*, in the equation:

$G^{E}_{m} = x(1-x)Lw$

where G_{m}^{E} = the excess molar free energy of mixing, x is the mole fraction and L is Avogadro's, number, may be calculated. This is something that has eluded us in the past.

LIST OF REFERENCES

- Hildebrand, J.H.; Scott, R.L. Solubility of Nonelectrolytes, 3rd Ed. Reinhold, NY (1950)
- 2. Boghosian S, Tumidajski, P.J, Blander, M. and Newman, D.S.,

Metallurgical and Materials Transactions, **31B** 597 (2000)