

rotational degrees of freedom being accessible to diatomic molecules but not to spherically symmetric rare gas atoms.²

Copeland and Zybko have observed Henry's law constants for high-pressure solubilities of Ar and He in molten NaNO_3 at 642°K.⁵ For Ar, $K_{h,\text{Ar}} = (17.2 \pm 1.7) \times 10^{-7}$ mole cm^{-3} atm⁻¹, and for He, $K_{h,\text{He}} = (22.7 \pm 0.7) \times 10^{-7}$ mole cm^{-3} atm⁻¹. The close-packed "spherical" radius of the N_2 molecule is very nearly the same as that of Ar (1.92 Å). Thus, the cavity creation work done against the *comparatively small* surface tension of NaNO_3 by either gas would be expected to be small and approximately the same for each. However, the polarizability of N_2 is 1.734×10^{-24} cm³ molecule⁻¹ as compared to 1.626×10^{-24} cm³ molecule⁻¹ for Ar.¹³ On this basis, one would expect slightly greater ion-induced dipole solvation effects for N_2 than for Ar, which would tend to make the former slightly more soluble if all other effects are nearly equal. The polarizability of He is only about

0.2036×10^{-24} cm³ molecule⁻¹,¹³ and its close-packed radius is about 1.22 Å.² Thus, much less work against surface tension is required to create a hole for a He atom than for either N_2 or Ar. However, solvation effects for He would be practically nonexistent. It would appear, therefore, that the slightly greater solubility of He might be primarily the result of the relative ease of introducing such a small atom into the liquid, in spite of the partially compensating solvation effects which exist for the larger solute molecules.

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(13) E. A. Moelwyn-Hughes, "Physical Chemistry," 2nd ed, Pergamon Press, Oxford, 1961, p 383.