SPECIALIA

A Note on Solutions Governing the Origin of Polytropes

In this note the author intends to give an entirely different proof, which is more logical, of his recent result that the origin of polytropes, whatever be the index, is governed by solutions of the LANE-EMDEN equation for either $n = 0$ or $n = -1$[1].

At the origin of the polytropes, dP/dr and $d\varrho/dr$ vanish: that is, at the origin, P and ϱ are not functions of r. Equations governing the hydrostatic equilibrium suggest that at any point in the configuration, where P and ϱ are related, both P and ϱ are functions of r simultaneously. Hence, at the origin, P and ϱ are independent of each other; but a polytropic model, in which P and ϱ are not related, cannot have any physical validity. This makes it clear that, at the origin, $P = K\varrho^{1+1/n}$ can be relevant only for such limiting values of n for which P and ϱ tend to become independent of each other. Thus, whatever be the index of the polytrope, the arrangement of solutions at the origin will be given by solutions for either n tending to zero or for n tending to -1.

If we consider the fundamental equation in terms of r and P, then solutions for $n = -1$ will govern the origin for the simple reason that for $n = 0$, P cannot be finite. For similar reasons if we consider the structure in $(r; \varrho)$-plane, solutions for $n = 0$ will govern the origin[2].

Zusammenfassung. Es wird bewiesen, dass für den Ursprung von Polytropen nur Lösungen der EMDEN-Gleichung vom Index 0 oder -1 sind.

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[1] S. SRIVASTAVA, Proc. natn. Acad. India [A] *35*, 909 (1966).

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Molecular Compounds Without Chemical Bonding

When benzene is added to a solution of nickel cyanide in aqueous ammonia containing acetic acid, a precipitate of the composition $[Ni(CN)_2 \cdot NH_3 \cdot C_6H_6]$ is formed[1]. Other examples of these addition compounds are those formed between nickel cyanide-ammonia complex $[Ni(CN)_2 \cdot NH_3]$ and molecules of aniline ($C_6H_5NH_2$), pyridine (C_5H_5N), pyrrole (C_4H_5N) and thiophene (C_4H_4S). Contrary to the statement of HOFMANN and KÜSPERT[1], we have found that phenol and furan do not form clathrates with nickel cyanide-ammonia complex[2].

A single crystal X-ray investigation was undertaken on the benzene clathrate[3]. The large distance between the carbon atoms of benzene and the atoms of the caging material was interpreted to mean that the organic molecules are not bonded but are simply caged in the crystal lattice.

We present here the IR-spectroscopic evidence that the organic molecules are just trapped in the cavities provided by the nickel cyanide-ammonia lattice and there is no chemical bonding between the guest and the host molecules.

The absorption frequencies of benzene attributed to in-plane vibrations are identical in clathrate and the pure liquid (or gas) but those attributed to out-of-plane vibrations are different (more or less shifted e.g. 675 cm^{-1} band of liquid benzene appears at 706 cm^{-1} in benzene chathrate). This is the only indication of interaction between the clathrated molecule and the nickel cyanide-ammonia lattice.

It can be stated that the clathrate bands with large shifts correspond to bands which in pure components or in a solvent show large shifts in comparison with gaseous molecules. For example, in benzene clathrate the wave number of A_{2u} out-of-plane band is 706 cm^{-1}; 687 cm^{-1} in the solid state, and 675 cm^{-1} in the vapour or liquid state. Similarly, in pyrrole clathrate $[Ni(CN)_2 \cdot NH_3 \cdot C_4H_5N]$ the wave number of the B_2 out-of-plane ν_{21} is 552 cm^{-1}; 561 cm^{-1} in the liquid state and 475 cm^{-1} in the vapour state. Hence the magnitudes of these shifts in clathrate bands in comparison with the bands in pure compounds are of the same order as the magnitudes of the shifts in liquid or solid spectra as compared with the gaseous spectra. It is, therefore, suggested that the forces which may be causing the minor shifts in clathrate spectra are of the same kind as the forces which cause the shifts in liquid or solid spectra, i.e. van der Waals forces.

LORENZELLI and ALEMAGNA[4] recently gave a broad band near 110 cm^{-1} in liquid pyrrole. They assigned this band to an intermolecular vibration involving complexes bound through hydrogen bonds. The pyrrole clathrate

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