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THERMODYNAMICAL BEHAVIOR OF DOPED Sm (III) IONS IN SATURATED ALCOHOLIC SOLUTIONS OF AMIDE GROUP CONTAINING LIGANDS DERIVED FROM HETEROCYCLIC AMINES

H. S. BHANDARI, D. D. GUDESARIA, S. PUROHIT and N. BHOJAK*

P. G. Department of Chemistry, Govt. Dungar College, M. G. S. University, BIKANER (Raj.) INDIA

ABSTRACT

The thermodynamical parameters of Sm (III) ions with a series of amide group containing ligands derived from heterocyclic amines in saturated alcoholic solutions have been studied with respect to hypersensitive transition involved in the system. The spectroscopic data for the hypersensitive transition have been correlated with thermodynamical parameter. T. E. T., for all complexes were found in the range 0.87×10^{17} to 1.02×10^{17} and work function in the range of 2.02×10^{19} to 2.33×10^{19}.

Key words: Sm (III), Amide group, Ligands, Heterocyclic amine, Thermodynamical parameters.

INTRODUCTION

Samarium is a rare metal, which ignites in air at 150°C having a bright silver lusture. Three crystal modifications of the metal also exist with transformations at 734°C and 922°C. It is also found with other rare earth elements in minerals including monazite and bastnaesite.

Samarium is primarily utilized in the production of samarium – cobalt Sm_2Co_7. permanent magnets and the nearnet shape production of Sm (Co, Fe, Cu, Zr)z bonded magnets makes them potentially superior to any other magnet made by sintering[1].

The Sm-Co magnets has superior and conventient magnetic properties as compared with conventional one[2]. Recently, few complexes of Sm have been synthesized by Mollouk et. al[3]. Ligands containing amide group (s) are potential models for naturally occurring biologically important complexes such as metal carrier protein metalloenzyme, antibiotics peptides also as catalysts and these have also been found as potential chelating agents[4,5].

*Author for correspondence;

The energy and intensity parameters of lanthanon chelates with variety of ligands have been studied for the interpretation of sharp line like bands arising from the transistion among different levels of $4f^n$ confriguration. Doped study of certain system finds immense applications. The study of hypersensitive transition plays an important role in estimation of ligand's environment of 4f orbitals. Present paper deals with thermodynamical treatment of hypersensitive transitions of various ligands. The thermodynamical treatment involves the determination of work function (A) and thermodynamic efficiency of transition (TET) from the spectroscopic data obtained for the system.

Thermodynamical parameters resulting from spectroscopic data also support the covalency in between the lanthanide ion and surrounding ligands. In continuation of earlier work on these ligands, We report herein the evaluation of parameters for the complexes of Sm (III) with few amide group containing ligands derived from heterocyclic amines.

EXPERIMENTAL

Synthesis of ligands

Five ligands containing amide group have been synthesized by refluxing 2-aminopyridine in equimolar ratio with acetyl chloride, benzoyl chloride, 2-hydroxy chloride, 3-hydroxy chloride, 4-hydroxy chloride for 5 to 6 hours at temperature 50^{o}C to 60^{o}C. The compounds were purified and crystallized in ethanol.

The saturated solution of ligands N-2' pyridyl acetamide (N2PA), N-2' pyridyl benzamide (N2PB), N-2' pyridyl 2-hydroxybenzamide (N2P2HB), N-2' pyridyl 3-hydroxybenzamide (N2P3HB) and N-2' pyridyl 4-hydroxybenzamide (N2P4HB) were prepared by dissolving them in ethanol and samarium carbonate was added to the solutions.

The solution spectra of the system were recorded by using standard spectrophotometer in the visible region. The calculation for various electronic parameters was made by computational method reported are earlier.

RESULTS AND DISCUSSION

The computed values of thermodynamical parameters for Sm (III) doped systems are reported in Table 1. These values reveal that the magnitude of T. E. T. for all complexes is in the range 0.87×10^{17} to 1.02×10^{17} and work founction is in the range of 2.02×10^{19} to 2.33×10^{19}.

Table 1: Thermodynamical parameters of hypersensitive transition for doped Sm (III) system

Sm (III) doped system	Energy (cm^{-1})	Oscillator strength (P x 10^6)	Work function (A x 10^{15} cm^{-1})	T. E. T. x 10^{17}
Sm-N2PA	22522 (22478.02)	52.39 (52.34)	20185 (20142.35)	0.8962 (0.8961)
Sm-N2PB	22522 (22458.90)	17.5 (17.4)	232321.29 (20185.6)	0.8982 (0.8972)
Sm-N2P2HB	22522 (22478.01)	12.81 (12.8)	20243.75 (20119.21)	0.8988 (0.8987)
Sm-N2P3HB	22522 (22458.90)	28.07 (28.0)	20337.78 (20293.00)	0.9029 (0.9027)
Sm-N2P4HB	22522 (22478.00)	19.9 (19.9)	20268.68 (20224.00)	1.0021 (0.8897)

Calculated value are indicated in brackets

Significance of thermodynamical parameters is well understood but their computation for the hypersensitive transition suggests the microscopic behaviour of f ↔ f transition. It is found that thermodynamical parameters are only slightly affected by various ligands.

Thus, the present study reveals that the microscopic behaviour of f ↔ f transition with respect to T. E. T. for Sm (III) doped system is almost same.

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