

(4) Stark effect. If surrounding ions or groups produce electric fields not of spherical symmetry around an actinide or lanthanide ion with unpaired electrons, the $(2J + 1)$ -fold degeneracy involving the spatial orientation of the total angular momentum vector J will be partially or completely broken up. The nature and extent of the splitting will depend upon the term value of the ion, and upon the symmetry and strength of the electric field. The splitting will be extremely small for the ions with electronic structure corresponding to the term $^8S_{7/2}$, i.e., Cm^{+++} and Gd^{+++} . If the magnitude of the Stark splitting is of the order of kT , the entropy of formation of the state in question may be altered significantly. The larger spatial extension of the $5f$ orbitals compared with $4f$ should make such effects greater in the actinide series than in the lanthanide series. Hence there may be differences between the two series, and between different elements within a series, in the entropy of formation of some complex ions.

It has been found that the formation of many organic complex ions causes a splitting of the absorption spectrum lines of praseodymium, neodymium and samarium.²⁰ Splitting of the order of kT (at room temperature) was observed for the citrate complex of praseodymium.

Measurements of the entropy change in the high temperature hydrolysis of the lanthanide trichlorides²¹ showed no differences which could be attributed to Stark splitting. The entropy of vaporization of PuF_3 is the same (within the limits of experimental error) as that of AmF_3 .²² Hence the difference in Stark splitting