and C^d is the dilation term or the difference between C_p and C_v. C^d can be neglected for all the rare earth metals at
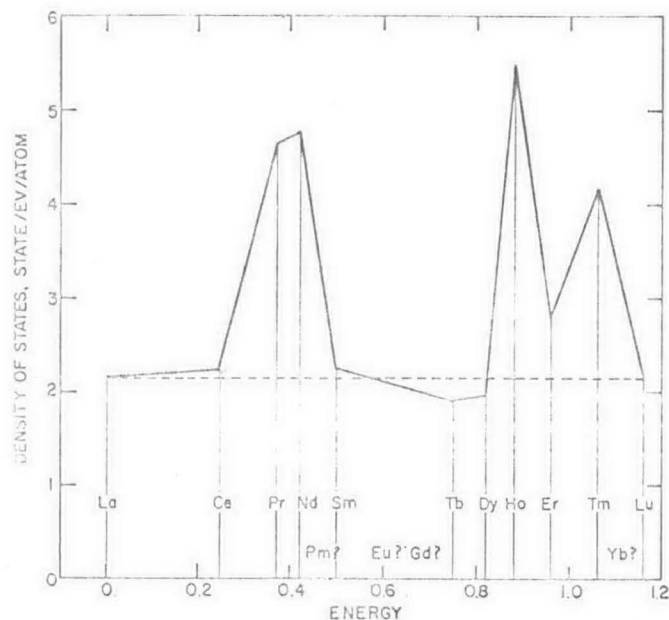

Fig. 1. Density of states values for the rare earth metals assuming that Eqn. (3) is correct and the linear contribution to the low temperature specific heat is representative of the electronic specific heat.

temperatures below 100°K, and, therefore, we can drop all subscripts in Eqn. (1). Of the terms in Eqn. (1), C^e is of prime importance here since it is directly proportional to the density of states of the electrons at the Fermi surface. The electronic contribution to the specific heat is given by

$$C^e = \gamma T \tag{2}$$

where T is the absolute temperature and γ is the electronic specific heat constant. The electronic specific heat con-

stant is related to the density of states, $N(E)$, for free electrons occupying a parabolic band by

$$N(E) = 3\gamma/2\pi^2 k^2 \tag{3}$$

where k is Boltzmann's constant. Stoner [8] has shown that Eqn. (3) is reasonably valid for any band form, except where the density of states varies rapidly with a small change in energy. The γ values for all of the elements have recently been summarized by Gschneidner [9] and are shown in Table I for the rare earth metals. Also included in Table I are some of the more recent values published by Lounasmaa [10, 11, 12] which differ considerably with the values listed by Gschneidner. [9] Examination of the γ values indicates a considerable variation as one proceeds along this series of elements, even if the values of α-Ce, Eu and Yb are excluded because they are not trivalent metals. The corresponding density of states values are shown in Fig. 1, assuming Eqn. (3) is valid. Since the outer electrons of these trivalent metals are presumably the $6s^2$ and $5d^1$, one would expect the density of states of these two bands to remain essentially constant for all the rare earth metals, as indicated by the horizontal dashed line in Fig. 1. If this is correct then the variation in the density of states must be due to the 4f electrons, which implies a broad 4f band which contains a number of peaks and valleys. (Fig. 1) The application of the rigid band model to the 4f transition metals would be expected to be valid in view of the success of this model for the d transition metals. [13, 14]. This means we could take the appropriate amounts of the two end-members, lanthanum and lutetium (ignoring crystal structure differences), and generate any of the other rare earth metals, e.g. a 13:1 atomic mixture of a La-Lu alloy (92.8 a/o La) would be equivalent to cerium, with one unpaired 4f electron, a magnetic susceptibility of about 2.4×10^{-3} emu/g-at. and a γ value of the order of 20 cal/g-at. deg^2. The low temperature data of Anderson, et al. [15] for some La-Lu alloys indicate absence of any appreciable