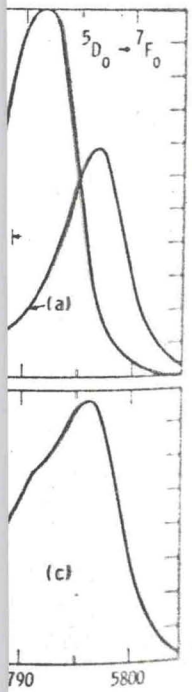
surprising degree
in Table I. In addi
served room-temp
using a 0.05M co
ation at this temp
lues listed in Table
and at $-30°C$.
e solutions containi
oncentration was
$\times 10^{-3}$ M. The thre
05M concentration
results are inclu
olinium salt did no

olution was a 1
ibed in detail along
later date.
y combining, in eth
roacetone and the
ide in the molar
dried at room temp
ase in satisfactory
4. The use of trie
ed tris chelate Eu(B
s compound.
hreshold energy re
was not expected
cate that each of the
degree to the free
litional information
n and quinolinium
l of those listed in T

0.05M solutions of
dentical. At 0.05M
ccurs in a 1-mm capil
he absorptions of



ence of 0.05M solu
Eu(BTF)$_4$ in acet

as are negligible compared to the anion. Therefore, "block-
of laser pump light by the cations does not take place to
important extent.

The absolute quantum efficiency of the piperidinium salt
M in acetonitrile, irradiated with 3150 Å light) has been
ured by comparison with rhodamine B as a standard[3,4]
found to be 0.75 ± 0.15. The ratio of the quantum efficiency
e quinolinium to the piperidinium salt solution is, however,
0.65. At room temperature about 95% of the total fluorescence
both solutions occurs near 6120 Å in the $^5D_0 \rightarrow {}^7F_2$ transition
acteristic of Eu^{+3}.

The possible reason for the lower quantum efficiency of the
olinium salt solution involves quenching of the anion emis-
by interaction with the quinolinium ion. If such a process is
ative, one would expect the quantum efficiency to decrease
the concentration of the chelate salt in solution is increased.
ever, while the quantum efficiency of the piperidinium salt
ained constant on increasing the concentration from 5×10^{-3} to
10^{-1} M, that of the quinolinium salt increased about 18%. This
lt indicates that such a quenching process is not taking place.
An alternate explanation for the lower quantum efficiency of the
olinium salt, which is consistent with the observed results,
be given in terms of the dissociation of the chelate anion,
ction 1.

$$Eu(BTF)_4^- \rightleftharpoons Eu(BTF)_3 + BTF^- \quad (1)$$

e quantum efficiency of the electrically neutral tris chelate
BTF)$_3$ in acetonitrile is only about $\frac{1}{10}$ that of PEu(BTF)$_4$
ations. Any dissociation according to (1), therefore, results
ower over-all quantum efficiencies.

Since the $^5D_0 \rightarrow {}^7F_2$ emission band for Eu(BTF)$_3$ occurs at
rly the same wavelength as for PEu(BTF)$_4$, the presence in
ation of Eu(BTF)$_3$ is more easily detected by means of much
ker $^5D_0 \rightarrow {}^7F_0$ emissions. Figure 1 shows this portion of the
rescence spectrum for solutions made up from PEu(BTF)$_4$,
BTF)$_3$, and QEu(BTF)$_4$, where Q is the quinolinium ion.
m the nearly symmetrical shape of the main peak of curve (a)
the relative intensities of curves (a) and (b), the amount of
BTF)$_3$ in the solution prepared from PEu(BTF)$_4$ is found to
less than 10% of the total europium present. Curve (c),
ever, shows an asymmetry which we attribute to the presence
ppreciable Eu(BTF)$_3$.

If f represents the fractional dissociation of tetrakis molecules
the quinolinium solution and r the ratio of the intensity of the
$\rightarrow {}^7F_0$ emission from tris molecules in the quinolinium solu-
n (c) to that from the pure tris solution (b), we have[5]

$$r = 3/4f. \quad (2)$$

nstructing curve (c) from the sum of two appropriate curves of
pe (a) and (b), we find f to be equal to 0.40.

The greater amount of Eu(BTF)$_3$ observed in solutions pre-
ed from QEu(BTF)$_4$ suggests that the quinolinium ion facili-
s the dissociation of Eu(BTF)$_4^-$. We postulate, as one possible
chanism, that this is the result of ion pairing according to
ction (3). To the extent that

$$Q^+ + BTF^- \rightleftharpoons Q(BTF), \quad (3)$$

occurs, BTF$^-$ is removed from solution and equilibrium (1)
hifted to the right.

In summary, the results presented here show that the cation in
salt BEu(BTF)$_4$ can be important in determining the laser
abilities of solutions containing the salt without interacting
ctly with the lasing species Eu(BTF)$_4^-$ to change its spectral
perties.

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Shock-Wave Compression of Germanium from 20 to 140 kbar*

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The object of this note is to report stress–volume results between 20 and 140 kbar for germanium, shock loaded in a state of one-dimensional strain along the [111] crystallographic direction. Resistance–time measurements, made while the shock wave traverses the sample, circumvent difficulties inherent in the usual free surface velocity methods.

Shock loading was accomplished by impacting large diameter-to-thickness ratio disks of germanium upon each other in order to ensure a state of one-dimensional strain in all but the periphery of the disks for the duration of the experiment. One disk, mounted on the face of a projectile, was accelerated to a measured high velocity by means of a compressed gas gun[1] and was impacted in vacuum upon the specimen disk mounted on the end of the gun. Angular misalignment between the impacting surfaces was about 5×10^{-4} rad.[2] Germanium back-up disks were mated to the rear of the specimen. The thicknesses of the impact and back-up disks were chosen so that the stress waves propagated through and out of the specimen disk without reflection until, finally, the specimen was stressed uniformly to the impact value for a brief interval preceding the arrival of unloading waves.

The disks, 38 mm in diameter, were cut from single crystals of high purity n-type germanium of nominal 50-Ω·cm resistivity and were oriented with their faces parallel to a (111) crystal plane. Their dislocation density was approximately $6 \times 10^3/cm^2$. Depending on the particular experiment, the thicknesses of the specimen disks were 3.2, 4.0, and 8.0 mm.

The resistance–time history resulting from stress waves propagating through the specimen was obtained by recording the voltage–time history across the thickness of the specimen disk under constant current conditions. The constant current of one ampere was applied to the specimen disk about 500 nsec before impact to prevent resistive heating of the disk. Both faces of the disk were entirely electroless nickel plated to provide Ohmic electrodes. The impact surface electrode of the specimen was also coated with vapor deposited silver and maintained at ground potential. The back-up disk assembly, entirely vapor coated with silver, served as the circuit lead to the other electrode.

For impact stresses in the range of several hundred kilobars, multiple waves are observed which indicate the presence of slope discontinuities, or cusps, in the stress–volume relation.[3] During the time these waves are propagating across the specimen thickness, the specimen is essentially divided into a number of zones separated by the different wave fronts. Thus, the electrical resistance between the electrodes of the specimen is equal to the sum of the resistances of the zones. Assuming time independent wave velocities, stress amplitudes, and resistivities, the initial

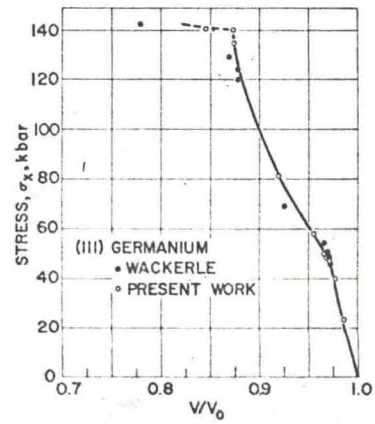

Fig. 1. Stress–volume relation.