

imparted to the III oxidation states of elements 96 and 103 by the half filled $5f^7$ and filled $5f^{14}$ shells that should occur in them if actinium really is the first member of a postulated new 5f rare earth series. He mentioned several times in the article, in fact, that Cm should exhibit the III state almost exclusively because of its $5f^7$ half filled shell.

Experimental determination of the extra chemical stability of the III oxidation state of curium relative to americium and berkelium furnished important early support for the actinide concept. Of parallel interest, but much later, it was shown also by R. J. Silva and co-workers (5) that Lr has a most stable oxidation state of III as predicted by Seaborg for the last member of the actinide series. This experiment on Lr (the only chemical one that has ever been performed on this element) was particularly important since shortly before it was done the surprising discovery had been made by Maly, Sikkeland, Silva, and Ghiorso that No, the second to the last member of the series, is most stable in the divalent state (6).

Although no additional chemical experiments have been possible yet with Lr, several types of experiments have demonstrated the extra stability of the trivalent state in Cm that Seaborg predicted. A good example is the heat of sublimation of Cm over that of Am and Bk. This effect is shown from data of Kleinschmidt, Ward, and Haire (7) in Figure 2. Their value of the heat of sublimation for Lr was predicted on the basis of its trivalency, which has already been established for the trivalent ion in aqueous solution as noted above. The low heats of sublimation of Fm, Md, and No were predicted on the basis of their expected divalency. Actually, the divalency of Fm and Md has been demonstrated experimentally already by the gas chromatography results of Hubener and Zvara (8) and there can be little doubt that No is divalent. So the heat of sublimation of Lr will be a most important quantity to measure. It may actually be much lower than predicted by Kleinschmidt and coworkers because, although Lr is trivalent in aqueous solution, the electronic configuration of the metal may be different from what would be predicted on the basis of analogy with Lu. Strong relativistic effects in the Lr region will definitely stabilize the $7s^2$ closed shell more than the $6s^2$ closed shell in Lu, and they also could cause the replacement of the expected 6d electron, which is very interactive, with a $7p_{1/2}$ electron, which is relatively inert. These two effects could work in conjunction to lower the heat of sublimation of Lr substantially (9).

Fortunately, it has become possible recently to experimentally demonstrate in a direct manner the extra stability of the highly localized $5f^7$ shell in curium. In essence, the approach is to test the stability of the f shells in transplutonium metals by placing them under a high enough pressure that they delocalize into the spd bands. That is to say that the pressure is high enough to cause the f electrons to change from a localized non-bonding character into a delocalized bonding character. A recent review has been given by Benedict (10).

All four of the metals - Am, Cm, Bk, and Cf - now have been studied (11,12,13). An illustration using results from a paper by Roof, Haire and coworkers (13) is given in Figure 3. In this experiment, Am metal