

Reply to the Comment on "Dependence of the Ta K x-ray energy on the mode of excitation"*

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The difficulties in interpretation of the K x-ray shifts are acknowledged. A new experiment confirms, with higher accuracy, the previously reported data and excludes the possibility of a chemical shift.

We agree with the preceding comment,¹ which points out that the tentative interpretation of the Ta K x-ray shifts,² based on the relatively large shake-off probability, disagrees with the commonly accepted calculations.³ Thus we cannot offer an interpretation of the observed shifts even if we assume that the shake-off probability accompanying fluorescence is larger than the shake-off probability accompanying electron capture. Our Hartree-Fock-Slater calculations and our experimental results which formed the substance of our paper² are, however, unchanged.

We have repeated our experiment with a different apparatus and different experimental procedures. Using an improved method to fluoresce the Ta x rays, we simultaneously took data from four sources: two oxides and two metals. For the Ta $K\alpha_1$ the observed centroid shifts (in eV) are for WO_3 - Ta_2O_5 , $-0.78(07)$; W - Ta , $-0.84(09)$; Ta_2O_5 - Ta ,

$-0.13(10)$; and WO_3 - W , $=-0.08(07)$. The first two numbers agree with our previously reported shift of $-0.67(13)$ eV. The last two numbers represent the chemical shift of the Ta $K\alpha_1$ and agree within errors with the result of Sumbaev *et al.*⁴: $-0.113(30)$ eV. The preliminary data on Ta $K\alpha_2$ and $K\beta_1$ shifts are also in agreement with the shifts given in Ref. 2. In Ref. 2 we also reported a difference in linewidth between the W and Ta sources. Our present results do not corroborate these findings. It appears that the instrumental linewidth is strongly dependent upon the source dimensions. Therefore we cannot distinguish which of the two modes of x-ray excitation produces a broader x-ray line. A future paper will detail our new experimental setup and the measurements of the tantalum $K\alpha_2$ and $K\beta_1, K\beta_3$ lines.

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¹M. S. Freedman, preceding Comment, Phys. Rev. A **16**, 1315 (1977).

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