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On Metal to Insulator Transitions in Bivalent Metal Clusters¹

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We discuss the issue of metal to insulator transitions in bivalent metal clusters, in view of our new photoelectron spectroscopy (PES) studies on Zn_n^- clusters in the size range of $n=3-117$. We show that zinc clusters exhibit a distinct transition in their electronic structure characteristics as a function of their size. At small sizes up to $n=18$ the clusters follow the Bloch-Wilson picture of the development of a metal from closed-shell atoms, exhibiting a gradual decrease of the gap between the fully occupied *s*band and the empty *p*band. For large sizes ($n \geq 32$) the band overlap allows the valence electrons to fully delocalize. This leads to an almost perfect free-electron density of states, as is demonstrated by discussing the spectra in the light of standard free-electron models and by comparison to the results obtained on sodium clusters. These results will be compared with the PES of Hg_n^- and Mg_n^- clusters.

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