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X-ray Absorption Study of Amorphous Metal Semiconductor Alloys M_xSi_{1-x} (M: Gd,Y) Near the Metal Insulator Transition ERIK HELGREN, F. HELLMAN, UC Berkeley, LI ZENG, UCSD, J.W. FREELAND, P. RYAN, D. HASKEL, R. WINARSKI, Argonne National Lab, M. VAN VEENENDAAL, N. Illinois University, R. WU, UC Irvine — X-ray absorption structure (XAS) at both Si K edges and Gd M edges were measured at compositions close to the metal insulator transition (MIT) for amorphous Gd_xSi_{1-x} (x = 0.11 - 0.21) and Y_xSi_{1-x} (x=0.13) from 10-300K. Spectral lineshape is unchanged as a function of composition, despite the presence of the MIT at x = 0.14. Comparison with calculations indicates that Gd is in the 3+ state for all compositions and temperatures measured. An anomalous temperature dependent absorption is seen below approximately 70K; the energies of the absorption peaks are unaffected, indicating no change in valence, but the absolute magnitude of absorption is temperature dependent for both K and M edges, up to 40 eV from the edges. This temperature dependence is related to changes in the nature of the conduction band states, specifically a transfer of weight from Si p-states to more localized Gd p-states. However similar shifts in the magnitude of the Si K edge are found in the non-magnetic analog system Y_xSi_{1-x}. Thus this transfer cannot be solely related to the magnetically-dependent localization phenomena previously observed in Gd_xSi_{1-x}, and we argue that it is related to electronic correlation effects present in both systems.

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