Abstract Submitted
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Anomalous hopping conduction in nanocrystalline/amorphous composites and amorphous semiconductor thin films[1] JAMES KAKALIOS, KENT BODURTHA[2], School of Physics and Astronomy, University of Minnesota — Composite nanostructured materials consisting of nanocrystals (nc) embedded within a thin film amorphous matrix can exhibit novel opto-electronic properties. Composite films are synthesized in a dual-chamber co-deposition PECVD system capable of producing nanocrystals of material A and embedding then within a thin film matrix of material B. Electronic conduction in composite thin films of hydrogenated amorphous silicon (a-Si:H) containing nc-germanium or nc-silicon inclusions, as well as in undoped a-Si:H, does not follow an Arrhenius temperature dependence, but rather is better described by an anomalous hopping expression ($\exp[-(To/T)^{3/4}]$), as determined from the "reduced activation energy" proposed by Zabrodskii and Shlimak. This temperature dependence has been observed in other thin film resistive materials, such as ultra-thin disordered films of Ag, Bi, Pb and Pd; carbon-black polymer composites; and weakly coupled Au and ZnO quantum dot arrays. There is presently no accepted theoretical understanding of this expression. The concept of a mobility edge, accepted for over four decades, appears to not be necessary to account for charge transport in amorphous semiconductors.

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