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Impact of Bond Coordination and Percolation on Mechanical Properties of a-SiC:H Thin Films SEAN KING, JEFF BIELEFELD, Intel Corporation, BRIAN DALY, Vassar College — Plasma Enhanced Chemically Vapor Deposited a-SiC:H thin films are compelling materials for both semiconductor nano-electronic and MEMS/NEMS technologies due to the extreme chemical inertness of this material and the ability to tune a variety of material properties across an extreme range of values. As one example of the latter, we demonstrate that using PECVD the Young's modulus of a-SiC:H thin films can be varied from < 10 GPa to > 200 GPa and the Hardness can be varied over an equally impressive range of $<$ 0.5 to > 30 GPa. Utilizing Fourier Infrared-Transform Spectroscopy, we show that this remarkable range in materials properties is achieved primarily via the incorporation of terminal hydrogen groups which lowers the overall connectivity of the Si-C network bonding. We find that once the average network coordination number for Si and C falls below 2.6, the Si-C network becomes under constrained and there is a loss of rigidity percolating through the system. There results are compared and found to be in agreement with constraint theory for amorphous materials.

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