

Metal Filament Formation in Amorphous Silicon

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Nonvolatile resistance change by the formation of metallic filaments in insulating matrices has received a great deal of interest for its application to nonvolatile memory¹. It has been cited as the mechanism for a host of resistance change phenomena in a variety of materials systems, including in solid oxides, metal chalcogenides, and organics. Recently superior switching behavior has been observed in metal contacted amorphous silicon, which has the notable advantage of being CMOS compatible^{2,3}. A great deal of work is required to understand in detail the exact mechanism for this type of switching in each materials system. In order to observe directly the proposed formation of a metallic filament in amorphous silicon, line cell devices with a metal-amorphous silicon-metal structure have been fabricated. Although the line cell architecture is not ideal for device integration, it does allow for characterization of the active region of the device by a wide variety of techniques, most notably in-situ examination of the filament formation process in the transmission electron microscope. Results on the fabrication, operation, and characterization of these devices will be reported.

¹ Waser R, Aono M. *Nature Materials*. 6: 833-840. 2007.

² Don YJ, Yu GH, McAlpine MC, Lu W, Lieber C. *Nano Letters*. 8(2):386-391. 2008

³ Jo SH, Lu W. *Nano Letters*. 8(2):392-397. 2008.
