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Physical and Electrical Characterization of HfO_2, $HfSiO_4$, and $ZrSiO_4$ Memristors Based on Sol-Gel Synthesis J.L. TEDESCO, WALTER ZHENG, S. POOKPANRATANA, A.A. HERZING, P.P. KAVURI, O.A. KIRILLOV, N.V. NGUYEN, C.A. RICHTER, National Institute of Standards and Technology — To date, most memristive devices have been fabricated by using TiO_2 or TaO_x dielectric films. In order to explore the possible advantages of other high-κ dielectrics in memristive devices, memristors were fabricated with HfO_2, $HfSiO_4$, and $ZrSiO_4$ layers synthesized from sol-gels. X-ray photoelectron spectroscopy measurements are consistent with reported spectra of HfO_2, $HfSiO_4$, and $ZrSiO_4$ films, but contain significant amounts of carbon. The films also have low densities and are flat, as measured by vacuum ultraviolet spectroscopic ellipsometry and optical profilometry measurements, respectively. This flat morphology is different from previous solution-processed dielectric films that exhibited rough surfaces [1]. Transmission electron microscopy measurements were also used to characterize these dielectric films. Current-voltage measurements indicate that, despite the contamination, the memristors exhibit nonvolatile bipolar resistive switching. The retention times measured for these memristors are $\sim 10^6$ s. Capacitance and conductance measurements of these memristors indicate differences between the ON and OFF states, which will be discussed further.

[1] J.L. Tedesco, et al., ECS Trans. **35**, 111 (2011).

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