Resistive Switching Memory Fabricated by Using UV-NIL Process

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Nanoimprint lithography is a low-cost method of fabricating nanoscale patterns as small as 6 nm [1–6]. It has been emerged as a key technology for the fabrication of devices with nanoscale patterns, such as polarizer, optical devices, bio devices, and patterned media. The ultraviolet nanoimprint lithography (UV-NIL) process is also a promising alternative to the expensive conventional optical lithographic process for producing non-volatile memory. Resistive random access memory (RRAM), which utilizes the resistance change effect of oxide material, has attracted considerable attention and been widely investigated due to its potential application in memory devices. Resistive switching phenomena have been observed in various oxide materials which are doped perovskite $SrZrO_3$, ferromagnetic materials such as (pr, Ca)MnO_3, and binary transition metal oxides such as NiO, TiO_2, Cu_xO, and Al_2O_3. A recent report indicates that Cu_xO film produced by plasma oxidation can be used for RRAM applications[4].

In this study, we investigate the characteristic of nonvolatile memory fabricated by the UV-NIL process. Bottom and top electrodes are fabricated by UV-NIL process. Figure 1 shows the fabrication process for the RRAM. The UV-NIL experiments are performed using SFIL process of Imprio 100 by Molecular Imprint Inc. In the UV-NIL process, low-viscosity picoliter volume resin droplets are dispensed on the Si substrate, where 50 nm thick Al is deposited. Quartz stamp with memory pattern engraved is pressed the dispensed resin and UV light is exposed to cure it. The imprinted polymer is transferred to Al layer by the dry etch process. To fill the gap between the metal line, Spin on glass(SOG) is used. By using a plasma oxidation, Al_2O_3 layer is formed on the Al bottom electrode. After Al deposition, above UV-imprint and etch process are performed again. Figure 2 shows the plot of current versus bias voltage of Al/Al_2O_3/Al structure.

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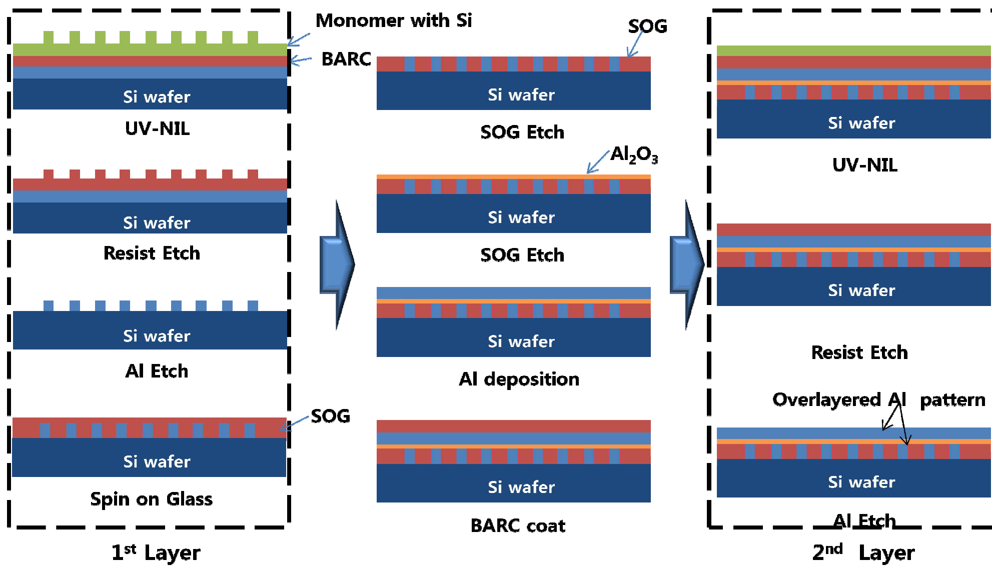

Figure 1. Fabrication process for nonvolitile memory by using UV-NIL

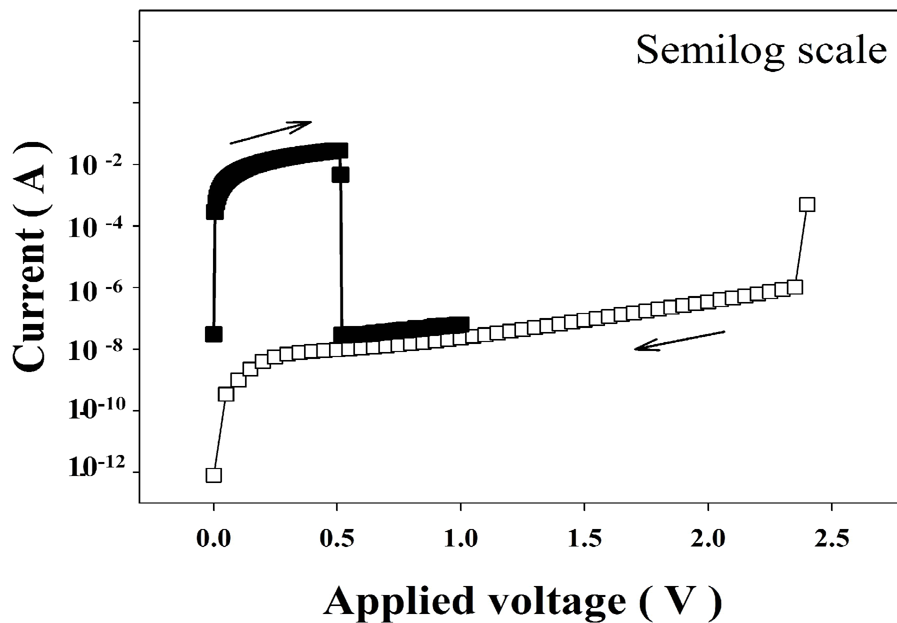

Figure 2. The I-V characteristics of Al/Al2O3/Al structure RRAM