Resistive switching characteristics of hafnium oxide nano-films on flexible plastic substrates

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Resistive switching devices based on metal oxides have received a great deal of attention in recent years, owing to promising characteristics for applications in next-generation non-volatile memory [1-2]. Moreover, flexible resistive random-access memories (ReRAM) have come to the forefront as emerging devices suitable for wearable devices [3]. In this study, we constructed ReRAM devices with resistive-switching layers of hafnium oxide (HfO_x) nano-films on flexible plastic substrates and examined the memory characteristics.

A gold bottom electrode was deposited on a plastic substrate by thermal evaporation and a HfO_x layer used as resistive material was sputtered onto the bottom electrode. And a platinum top electrode was then deposited onto the resistive-switching layer by thermal evaporation. The area of patterned electrodes was 10^4 μm^2. All the electrical measurements were conducted at room temperature.

The thickness of the HfO_x layer estimated from a field emission transmission electron microscope image is about 20 nm, as shown in Fig. 1. The Au/HfO_x/Pt device exhibits a ratio of the high resistance (HRS) to low resistance states (LRS) of more than 10^5, and this large resistance ratio is maintained even after 10^4 seconds as depicted in Fig 2. In addition, the resistive switching characteristics of our device are still observed when the substrate is upwardly bent with a strain of 0.45%.

References

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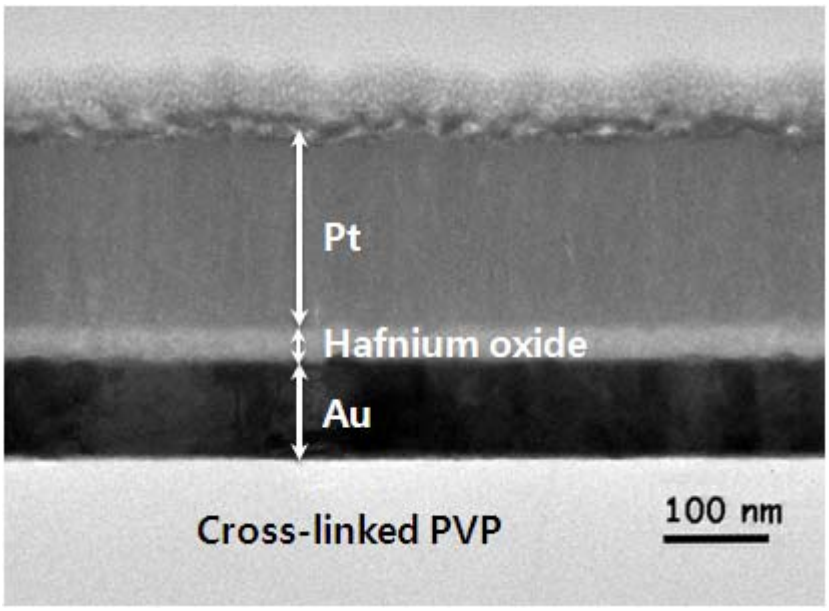

Figure 1: A FE-TEM image of Au/HfO$_x$/Pt device fabricated on plastic

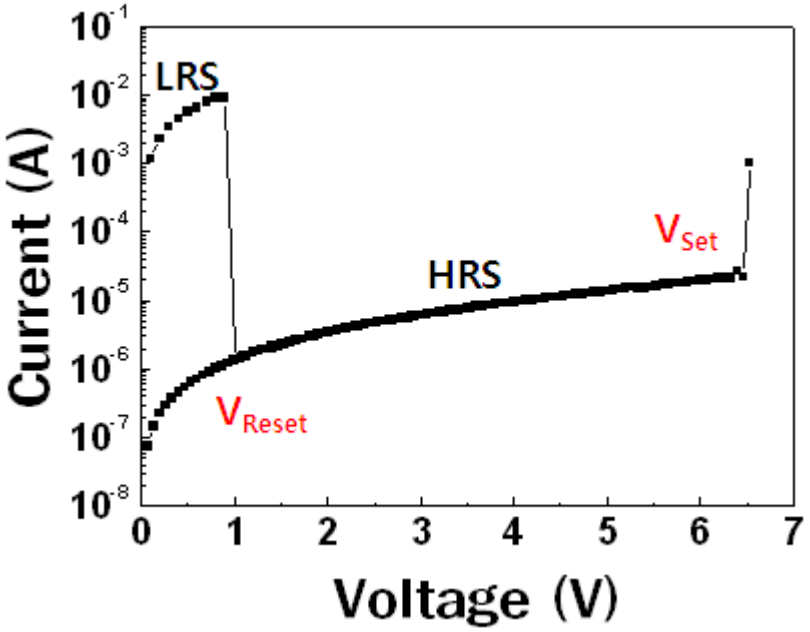

Figure 2: I-V characteristics of the Au/HfOx/Pt device