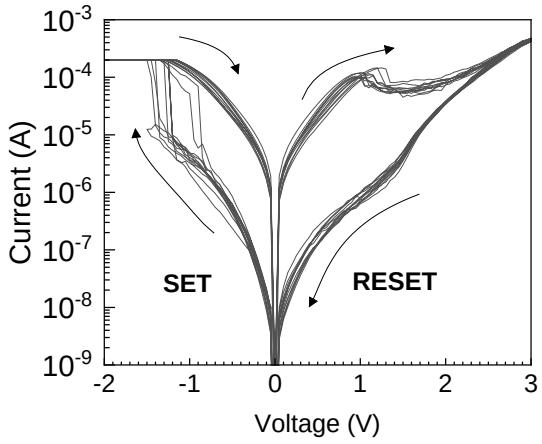

Figure 1. Clockwise bipolar resistive switching current-voltage characteristic of HfO_2 thin film grown from $HfCl_4$ and O_3.

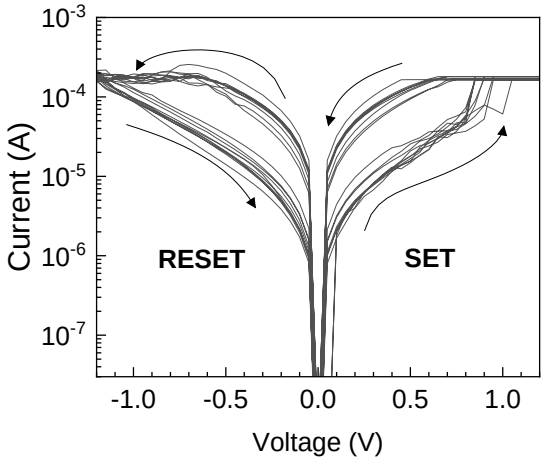

Figure 2. Counterclockwise bipolar resistive switching current-voltage characteristic of HfO_2 thin film with Ni particles grown from $HfCl_4$ and O_3.

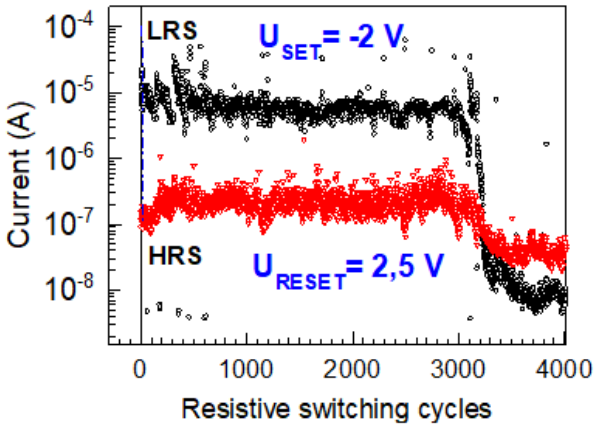

Figure 3. Change of bipolar resistive switching direction after 3200 cycles during endurance measurements of a HfO_2 thin film grown from $HfCl_4$ and O_3.

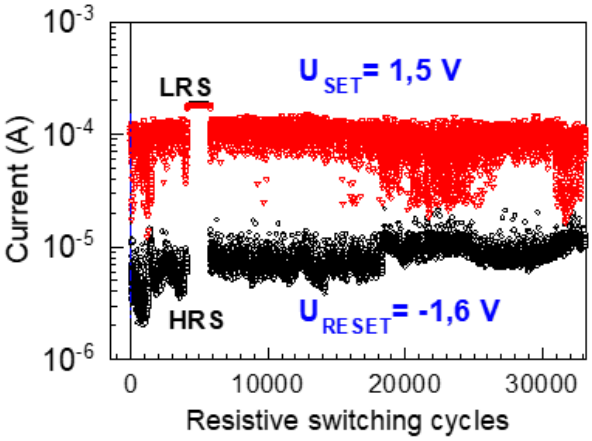

Figure 4. Endurance measurements with duration of 3.3 $\times 10^4$ cycles applied for a HfO_2 thin film with Ni particles grown from $HfCl_4$ and O_3.

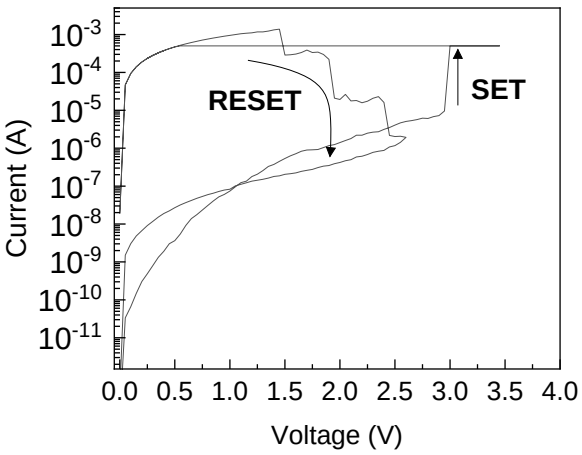

Figure 5. Unipolar resistive switching current-voltage characteristic of a HfO_2 thin film grown from $HfCl_4$ and O_3.

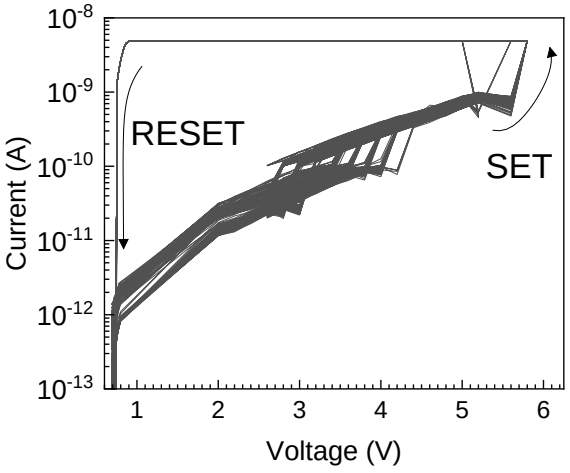

Figure 6. Unipolar resistive switching current-voltage characteristics of a HfO_2 thin film grown from TEMAH and O_2 plasma.