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Reproducible Resistance Switching and Physical Characteristics of TiOx films with Oxidation Temperature and Time

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In this work, we investigated the effect of the oxidation temperature on the unipolar and bipolar resistance switching behaviors of the oxidized TiO-x films. TiOx films on Pt electrodes were fabricated by the oxidation of Ti films at 550°C for 1 to 3 hours. The unipolar and bipolar resistance switching properties were investigated with the oxidation temperature and time. Also, the crystal structure and the physical properties such as chemical bonding states of TiOx layers were characterized in addition to the resistance switching characteristics.

The resistance switching behaviors of TiOx films oxidized at above 450°C and below 650°C was shown. So, we investigated that the resistance switching behaviors of TiOx films oxidized at 550°C with the oxidation time from 1 to 3 hour. The memory windows of unipolar switching in the oxidized TiOx films were reduced with increasing the oxidation time, but those of the bipolar switching were slightly enlarged. The enlargement of rutile TiO2 peak with increasing the oxidation time and temperature was studied by X-ray diffraction. An increase of non-lattice oxygen and Ti3+ in the TiOx films with the oxidation times was investigated by X-ray photoemission spectroscopy. It was expected that the uipolar and bipolar resistive switching of the oxidized TiOx film was strongly related with the migration of non-lattice oxygen anions and schottky barrier height, respectively.