Electrochromism (EC) is defined as a phenomenon in which a change in color takes place in the presence of an applied voltage. Because of their low power consumption, high coloration efficiency, EC devices have a variety of potential applications in smart windows, mirror, and optical switching devices. An EC devices generally consist of a transparent conducting layer, electrochromic cathodic and anodic coloring materials and an ion conducting electrolyte. EC has been widely studied in transition metal oxides (e.g., $\text{WO}_3$, $\text{NiO}$, $\text{V}_2\text{O}_5$).

Among these materials, $\text{WO}_3$ is a most interesting material for cathodic coloration materials due to its high coloration efficiency (CE), large dynamic range, cyclic reversibility, and low cost material. $\text{WO}_3$ films have been prepared by a variety of methods including vacuum evaporation, chemical vapor deposition, electrodeposition process, sol–gel synthesis, sputtering, and laser ablation. Sol–gel process is widely used for oxide film at low temperature in atmosphere and requires lower capital investment to deposit large area coating compared to vacuum deposition process.

In this study, electrochromic properties of $\text{WO}_3$ film were investigated under different preparing temperature condition. The results indicate that electrochromic properties of the sol–gel $\text{WO}_3$ film has fast response time and large transmittance change. Fig. 1 shows electrochemical properties of sol–gel $\text{WO}_3$ film in the condition of different reactive temperature. The structure, composition and morphology of $\text{WO}_3$ film analyzed using X-ray diffraction (XRD), field emission scanning electron microscopy (FESEM), X-ray photoelectron spectroscopy (XPS). The electrochemical behaviors of each film were investigated by cyclic voltammetry and chronoamperometry. The optical transmittance was simultaneously measured in-situ during all experiments by using He–Ne laser.

Fig. 1 Electrochemical properties of tungsten oxide by preparing sol under different temperature condition: (a) 70°C (b) 25°C