Bleached-state transmittance in charge-unbalanced all-solid-state electrochromic devices

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An EC device generally consists of a transparent electrically conducting layer, electrochromic cathodic and anodic coloring materials, and an ion conducting electrolyte. Tungsten oxides and Ni oxide/hydroxides are currently in widespread use as cathodic and anodic coloration materials, respectively. An all-solid-state EC device composed of W oxide and Ni hydoxide with a Ta_2O_5 protective layer, as shown in Fig. 1, was prepared by RF magnetron sputtering and lamination with a proton-conducting solid polymer electrolyte [1], because of advantages such as high durability, the prevention of bubble formation and sealing problems during manufacture.

In order to obtain the optimized maximum optical attenuation of the complementary EC device, charge capacities on both EC layers, cathodic and anodic coloration materials such as W oxide and Ni hydroxide, must be balanced. However, it is practically difficult to fix the charge balance between them. As a result, the bleached state of the EC window may have residual coloration due to incomplete EC reaction.

Our goal is to reduce this charge-unbalanced effect on the EC devices. Whether an initial state of each EC layer before the lamination process is colored or bleached may affect the bleached transmittance of the all-solid-state EC device. Therefore, the initial states of the W oxide and Ni hydroxide were varied before the lamination process and the bleached-state transmittance of the all-solid-state EC devices were then compared with the charge capacity ratio between the EC layers.

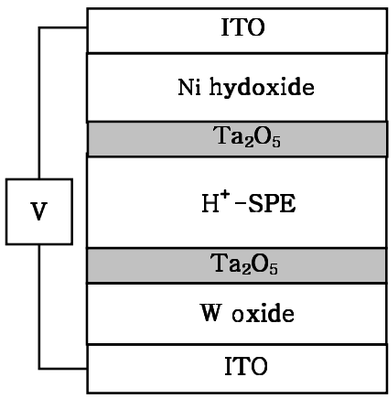

Figure 1. Schematic diagrams of all-solid-state EC devices

References

[1] K. S. Ahn, Y. C. Nah, Y. –E. Sung, K. Y. Cho, S. S. Shin, and J. K. Park, Appl. Phys. Lett. **81** (2002) 3930.