Colour Neutrality For Oxide Thin Films Prepared By Pulsed Laser Deposition And Sol-Gel.

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The most studied electrochromic material remains by far WO3 that switches reversibly from white/yellow to blue upon electrochemical oxidation and reduction. The light blue coloration of the tungsten oxide in the reduced state is undesirable for building applications for which a more neutral color is commercially required. In search of color neutrality, two different routes were investigated : the first one consisted in preparation of binary mixed tungsten oxides exhibiting a neutral color in the reduced state whereas considering the neutral colour of a complete device, the cathodic electrochromic tungsten oxide WO3 can be combined to anodic electrochromic material such as NiOx.

Oxides thin films were first deposited by Pulsed Laser Deposition. The PLD technique, which allows combinatory chemistry, is a unique tool for material optimization. Films grow rapidly, from a small amount of target material while maintaining the target to film composition. The optimized film composition being identified, films were deposited by sol-gel. Indeed in contrary to the Pulsed Laser Deposition technique, which remains limited for commercial applications, this low cost technique allows large scale production.

Among a broad range of mixed elements (Ni, Cr, Ti V, Nb), the W-V-O PLD thin films containing less than 20% of vanadium were identified as being the most promising for neutral color property in the reduced state [1]. The optimized composition being identified, the beneficial effect of vanadium was investigated on large area substrates by spin and dip coating. Whatever the deposition techniques, W-V-O thin films exhibit similar specific features that will be presented in relation with the conditions of deposition for each technique.

Colour neutrality was also achieved on a large scale 35*35 cm2 device when combining the cathodic electrochromic tungsten oxide WO3 with anodic electrochromic material such as NiOx.

In summary, in this paper, we will present two routes to reach neutral color property in an electrochromic protonic device, by means of two complementary techniques, namely Pulsed Laser Deposition and Sol-Gel.

[1] A. Rougier, A. Blyr, and A. Quédé., J. Electrochem. Soc., 148(2), 7 (2001).