Deposition of Nanostructured Nickel Oxides by Amino Acid Chelated Complexes: Benefits of Mixed Side Chains on the Formation of Nanostructures for Energy-efficient Electrochromic Windows

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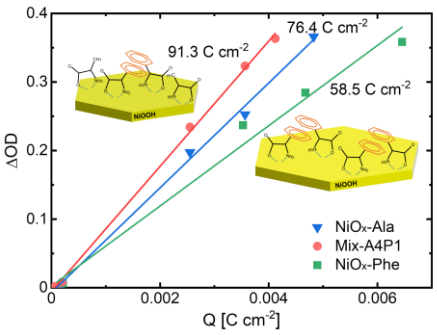
Keywords: Electrochromic metal oxides; X-ray absorption fine structure; Methyl side chain; Aromatic side chain; Energy-saving material

To accomplish specific climate control tasks in buildings, electrochromic (EC) windows must exhibit acceptable levels in specific performance indicators. Nickel oxide (NiO_x) has shown promise for use as switchable glazing in EC windows. However, the poor optical memory and cycling stability of NiO_x limited its commercial exploitation. Here, we present a strategy for electrodepositing a nanostructured EC NiO_x by controlled release of Ni(II) ions from L-alanine and phenylalanine ligands. Our main finding was that the sample deposited from rapid release of Ni(II) ions from L-alanine ligands had a relatively smooth surface morphology consisting of closely packed nanodeposits. This structure yielded great improvements in the cycling stability and coloration efficiency (CE). By contrast, the slow release of Ni(II) ions from phenylalanine ligands resulted in the formation of conglomerated island structures, which caused a low CE and poor cycling stability. However, the bulky aromatic side chains on phenylalanine could passivate the sample surface, thereby improving its optical memory. The aromatic side chains also contributed to the charge transfer between the solid-liquid interface of the sample. Critically, samples prepared from the mixed L-alanine and phenylalanine complexes showed greatly improved EC performance without compromising its superior optical memory and rapid charge transfer characteristics. We believe that this manuscript is suitable for publication by your journal because it provides new insights for the preparation of energy-saving EC oxide nanostructures via amino acid complexes, where the compositions and morphologies have the potential to be further developed.



1) Wang et al, *Appl. Surf. Sci* **2021**, *568*, 150914. 2) Wang et al, *ACS Appl. Nano Mater.* **2020**, *3*,