XPS Study Of Transition Metal Doped Silicate Glasses

Mekki, A; Salim, M

ELSEVIER SCIENCE BV, JOURNAL OF ELECTRON SPECTROSCOPY AND RELATED PHENOMENA; pp: 227-232; Vol: 103

King Fahd University of Petroleum & Minerals

http://www.kfupm.edu.sa

Summary

X-ray photoelectron spectroscopy (XPS) has been used to study the redox state of transition metal oxides in sodium silicate glasses with compositions 0.30Na(2)O-0.70SiO(2) and 0.3Na(2)O-0.6SiO(2)-0.1TMO, where TMO=Fe2O3, CuO and CoO. From the analysis of the core level spectra of the transition metals, it was found that both Fe2+ and Fe3+ exist simultaneously in the iron doped glass, while Cu+ was the only species present in the copper doped glass. In the cobalt doped glass, Co2+ was found to exist in both tetrahedral (tet) and octahedral (oct) co-ordinations. From the analysis of the O Is spectra, it was possible to discriminate between bridging and non-bridging oxygen atoms in each glass sample. It was also shown that the non-bridging oxygen contribution to the O Is spectra can be simulated by summing the contributions from SiONa, SiOFe2+ and SiOFe3+ for the iron doped glass, SiONa and SiOCu+ for the copper doped glass and SiONa, SiOCo2+(tet) and SiOCo2+ (oct) for the cobalt doped glass. The quantitative values for the [Fe2+]/[Fe] and [Co2+(tet)]/[Co] concentrations ratios were found from the analysis of the Fe 3p and Co 3p core level spectra, respectively. (C) 1999 Elsevier Science B.V. All rights reserved.

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