Voltammetry and oxygen activity in SnO2-doped alkali free aluminoborosilicate melts

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Abstract

Voltammetry using platinum crucible is a powerful tool to trace the redox reaction of multivalent element in-situ in melt state electrochemically. In the last three decades a lot of studies on redox behavior of various single multivalent elements in silicate or borosilicate melts was performed by voltammetry from the viewpoint of thermodynamics and kinetics for the reduction of M(x+n)+ to Mx+ (This is hereafter designated M(x+n)+/Mx+). Platinum crucible has a great advantage from the viewpoint of no reaction with melts. But it is sensitive to electric field.

In the present work, voltammetry experiments for alkali free alumino-borosilicate melts (E-glass) doped with Sn were performed in a crucible of platinum, silica glass and sintered alumina, respectively. Oxygen activity was also determined in a crucible of sintered alumina and silica glass, respectively. In voltammograms derived from three kinds of crucible, peak potential position due to Sn4+/Sn2+ at constant temperature was compared one another and its reproducibility at each crucible was estimated. Finally the real redox ratio [Sn2+]/[Sn4+] at some temperatures was calculated from peak potential and oxygen activity.

Keywords: Oxygen activity, Voltammetry, Crucible, Melts, Redox ratio

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