Electrolytic Recovery of High Purity Zr from Radioactively Contaminated Zr Alloys in Chloride Salts

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It has been believed that high purity Zr metal is hard to be prepared from Zr alloys in LiCl-KCl salts since Zr has various redox reactions in LiCl-KCl including insoluble ZrCl formation and disproportionate reaction between Zr and Zr^{4+} . We examined electrolytic Zr recovery from Zircaloy-4 by controlling anodic potential at five concentrations of $ZrCl_4$ in LiCl-KCl salts. Anode potential of -0.9 V (vs. Ag/AgCl) was applied to prevent the elements except Zr being dissolved from the anode into the electrolyte. Experimental results showed Zr with purity of over 99.9% was recovered and all alloying elements were analyzed below their detection limit in ICP-MS. In addition, at low $ZrCl_4$ concentrations of 0.1 and 0.5 wt.%, the chemical form of the cathode deposits was Zr metal without ZrCl while only ZrCl without Zr metal was recovered at the high $ZrCl_4$ concentration, 2.0 and 4.0 wt.%. At the $ZrCl_4$ concentration of 1.0 wt.%, both Zr metal and ZrCl were recovered. Therefore, preparation of high purity Zr metal from Zr alloys is feasible in LiCl-KCl at low concentration of $ZrCl_4$.

Keywords: Electrolytic recovery, Electrefining, Zr recovery, High Purity Recovery, LiCl-KCl

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