Formation of Gd-Al Alloy Films by a Molten Salt Electrochemical Process

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The electrochemistry of molten LiCl-KCl-$GdCl_3$ at a reactive Al electrode has been studied at 723 to 823 K. Electrochemical techniques such as cyclic voltammetry and chronopotentiometry have been used in order to identify the intermetallic compounds formed. Cyclic voltammetry showed that, while at an inert W electrode $GdCl_3$ is reduced to Gd metal in a single step at a potential close to the reduction of the solvent, at an Al electrode a shift towards more positive values occurs. This shift of the cathodic potential indicated a reduction of the activity of Gd in Al with respect to that of W, due to the formation of alloys. The surface characterization of samples formed by both galvanostatic and potentiostatic electrolysis has shown the presence of two intermetallic compounds: $GdAl_3$ and $GdAl_2$. Using open-circuit chronopotentiometry it has been possible to measure the potentials at which these compounds are transformed into each other. The values of these potential plateaus, once transformed into e. f. m. values, allowed to determine the thermodynamic properties of the $GdAl_3$ intermetallic compound.

Key words: Molten Salts; Gadolinium; Electrolysis; Alloy Formation; Pyrochemical Processes.