Poster No. 234

ELECTROCHEMICAL DEPOSITION OF TITANIUM and ALUMINIUM from EQUIMOLAR AlCl3 + NaCl MELT

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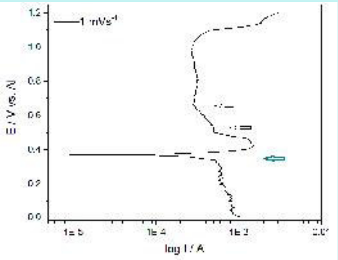
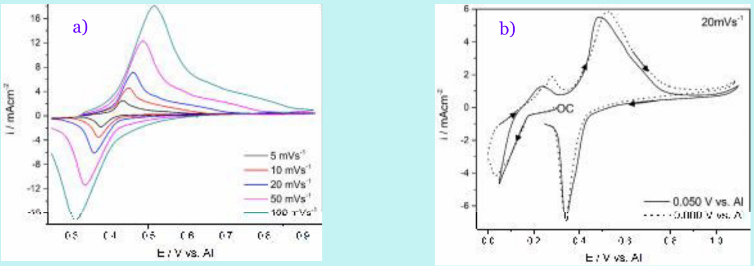
- The importance of aluminium-titanium intermetallic compounds derives from their low weight and high specific strength, stiffness, good oxidative and creep resistance and excellent high temperature properties.
- The area of application of aluminium-titanium intermetallic materials: structural materials in aerospace industry (engines, aircraft parts..), military, automobile sectors, medical devices, etc.
- Our interest is Al-Ti electrodeposition from equimolar chloroaluminate molten salts containing up to 0.97 atomic percent Ti ions in the bath by electrochemical dissolution of metal Ti.
- This procedure may be a useful route for a practical application perspective, e.g., Al-Ti alloy formation by Ti recycling from scrap.

- The idea is to developed low-cost titanium alloys production with the intention of applying them, in large quantities, to our daily life.
- Electrodeposition is an attractive method for fabricating intermetallic compounds since high temperature consolidation is unnecessary, undesirable compositional inhomogeneity is very limited in scale, and grain sizes are typically very small.

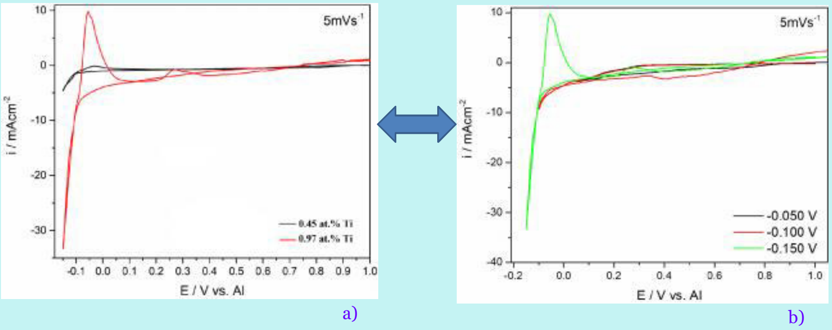
- ✓ Electrolyte: Equimolar AlCl3+NaCl, under Ar atmosphere;
- ✓ Working electrode-WE: Ti or GC;
- ✓ Reference electrode-RE: Al;
- ✓ Counter electrode-CE: Ti;
- ✓ Working Temperature: 200°C
- ✓ Techniques applied: LSV, Potenciodynamic, Potentiostatic;
- ✓ Structure analysis: SEM, EDS.



Potentiodynamic polarization curve of Ti electrode, ν = 1mV/s; E_i = 0.000 V → E_f = 1.200 V vs. Al

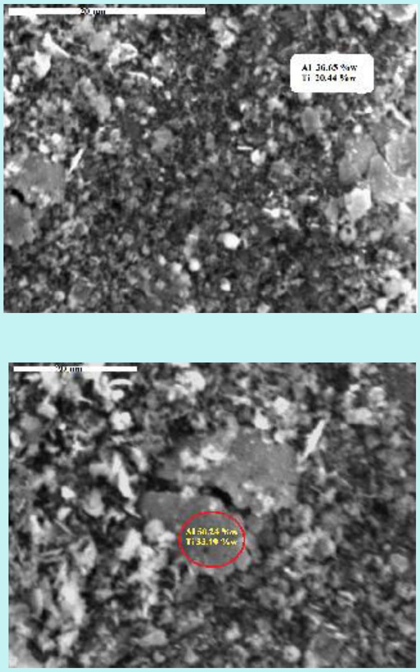


Linear sweep voltammograms of Ti WE in equimolar melt $AlCl_3$+NaCl; Potential change: a) OC→ E_a = 0.600 V vs. OC → E_f=0.250V vs. Al; b) OC → E_k different cathodic end → E_a=0.800V vs. OC → E_f=0.250 V vs. Al



Linear sweep voltammograms of GC WE in equimolar melt $AlCl_3$+NaCl+anodically dissolved Ti; a) cathodic end -0.150 V vs. Al; b) at different cathodic ends, dissolved Ti conc. 0.97 at.% Ti.

- ❖ Potentiometric measurements made with Ti WE have indicated reversible potentials of titanium around 0.370 V vs. Al; Ti^{2+}/Ti^{3+} and Ti^{3+}/Ti^{4+} redox transitions at around 0.500 V vs. Al and 0.700 V vs. Al, respectively. Chlorine evolution appears around 1.100 V vs. Al.
- ❖ LSV diagrams revealed that there is the titanium deposition onto GC in the presence of aluminium even when titanium concentration is very low.
- ❖ The deposit is not in the form of a solid cover of the GC substrate but rather in the form of very fine metal powder.



SEM micrographs of GC WE in equimolar melt $AlCl_3$+NaCl+anodically dissolved Ti conc. 0.97 at.% Ti; Inserted EDS data of the deposit obtained potentiostatically at -0.400 V vs. Al.

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