A high performances aluminum/graphite battery

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Modern society is in urgent need of sustainable and efficient energy storage devices. The renewable energy production is characterized by an intermittent power output, and requires for large scale applications an improvement on the capability of energy storage (currently less than 1% of the electrical energy production can be stored). The development of low cost and environmentally friendly electrochemical storage systems characterized by high performance is of fundamental importance for a sustainable energy economy. The currently most mature battery technology is the lithium ion battery, considered one of the most appealing candidates as power source for electric vehicle applications. However, the large-scale application of lithium ion batteries is nowadays under discussion due to the limited amount of lithium resources. Several other metallic anodic materials such as sodium, potassium, calcium, magnesium and aluminum [1,2], characterized by a higher abundance with respect to lithium, have been considered as suitable candidates for electrochemical storage devices in replacement of lithium systems. In particular aluminum, the most abundant metallic element in the earth's crust, is considered a promising candidate for application in stationary electrochemical storage systems. The light weight of aluminum and its ability to exchange three electrons during the electrochemical process ($Al^{3+} + 3e^- \leftrightarrow Al$) grant both, a high gravimetric and volumetric capacity density of 2.98 Ah g^{-1} and 8.04 Ah cm^{-3}, respectively, the latter value being four times as high compared to a lithium metallic anode. Additionally, the aluminum can be handled in open air leading to enormous advantages in the cell fabrication and an extreme improvement of the safety level of electrochemical storage systems employing this electrode material. In our work we propose the use of advanced graphite cathode material for the application in aluminum batteries. Electrochemical tests have been performed employing 1-ethyl-3-methylimidazolium chloride (EMImCl) ionic liquid and $AlCl_3$ in a molar ratio of EMImCl:$AlCl_3$ 1:1.5 as the electrolyte. [3,4]

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