Dr Khalil Amine

Argonne Distinguished Fellow and Director of the Advanced Lithium Battery Technology Program
Argonne National Laboratory, USA

Dr Khalil Amine obtained his MA in Chemistry and PhD in Materials Science from the University of Bordeaux in France in 1986 and 1989 respectively. Prior to joining the Argonne National Laboratory in 1998, he led research projects in the research arms of public and private organizations and universities, including the Japan Storage Battery Company, the Osaka National Research Institute, and Kyoto University. He is currently an Argonne Distinguished Fellow and the Director of the Advanced Lithium Battery Technology Program at Argonne. Since June 2015, he has become the Director of the Clean Vehicles Consortium in the US-China Clean Energy Research Center.

Dr Amine is responsible for directing the research and development of advanced materials and battery systems for Hybrid Electric Vehicles (HEV), Plug-in Hybrid Electric Vehicle (PHEV), Electric Vehicles (EV), and satellite, military and medical applications at Argonne. He is an advisor to the US National Research Consul on battery related technologies and an active member of the Electrochemical Society (ECS), the Material Research Society and the American Ceramic Society. He also serves as the Chair of the 16th International Meeting of Lithium Batteries (IMLB) and the Editor of the journal, Nano-Energy.

Dr Amine is a five-time recipient of the R&D 100 Award, which is considered as the Oscar of technology and innovation. From 1998 to 2008, he was the most cited scientist in the world in the field of battery technology. He was recently awarded the ECS Battery Technology Award and the International Battery Association Award. He holds or has filed over 167 patents and patent applications and has over 407 publications.

Advanced Energy Storage Systems for Smart Grid Applications

Abstract:

Over the last several years, large battery energy storage systems (BESS) have been deployed for a variety of grid applications. For these applications, BESS are expected to follow signals corresponding to power intensive and energy intensive applications for long periods of time without degradation of performance. This presentation will discuss four different battery chemistries that has the potential of been used in grid application for both smoothing where high energy is required or frequency regulation where high power and fast response is needed. The first chemistry is for high frequency regulation and is based on Mn spinel and lithium titanite. This system provides significant power that can be used not only for grid but also for hybrid electric vehicle. The second chemistry is lithium sulfur that provides low cost and high gravimetric energy density. We will show how Se doping of S can overcome the conductivity issue of S and eliminate the dissolution of poly-sulfide using an advanced electrolyte system. We also show that by incorperting Li2S in graphene cages, we increase the loading significantly to 10mg.cm-2 and eliminate the issue of cathode swelling that impact performance. The final system is Na ion battery that offers also the potential of high energy low cost and long life. We will show that in case of Na-Mn-Ni-Co layered oxide, the intergrowth P2/O1/O3 phases can inhibit the irreversible P2-O2 phase transformation and simultaneously improve the structural stability of the O3 and O1 phases during high-voltage cycling leading to high capacity and excellent cycle life. We will also disclose a novel red phosphorous anode that exhibit 2000 mAh/g when alloyed with Na with outstanding cycle life. Finally, by coupling the 3 phase Na-cathode with the red phosphorous, the resulting cell shows very high energy and good cycle life that can be used as a low-cost system for grid application. The four system is based on advanced lithium ion battery that offers 350wh/kg energy density based on Gradient high capacity Full gradient cathode coupled with Si/graphene anode with novel prelithiation concept.