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Li-organic batteries and beyond

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A lot of research has been recently focused on the development of new battery technologies, which would replace existing Li-ion batteries. Main research goal is to develop batteries with higher energy densities that would be at the same time produced from cheap and sustainable materials. One of the promising technologies is Li-Organic batteries. Some results on Li-Organic systems have shown capacities as high as 600mAh/g, but with limited electrochemical stability. The major problem of organic materials is their dissolution in electrolyte inside the battery, which results in large capacity losses during cycling. There are several approaches to overcome this issue: polymerization of organic molecules, use of iono-selective separators, grafting on solid support, use of solid electrolytes, use of insoluble active materials, etc. Our work has started in the field of grafting, where electroactive calixarenes were grafted on inactive carriers. However, grafting approach has also severe limitations due to addition of electrochemically inactive support that lowers the mass of active material. To minimize this effect we pursued new electrode preparation approach through use of grafted graphene nano-ribbons without any binder or additional conductive carbon (electrochemically inactive). This could improve the overall capacity of the battery. Third research direction is use of electro-active polymers that exhibit very stable capacities and we are currently focused on new polymerization procedures with purpose of obtaining higher capacities. Another advantage of organic materials is also the possibility of use in beyond Li battery systems. We have recently implemented electro-active organic polymer into the magnesium organic battery and have obtained promising results.

Biography

Klemen Pirnat has completed his PhD in 2013. His research was mainly focused on grafting of electro-active organic compounds on different non-soluble carriers as a method to achieve stable cycling in Li-Organic batteries. After PhD, he continued with his work on Li-Organic batteries in the field of electro-active polymers. He has published 8 papers which are cited more than 67 times.

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