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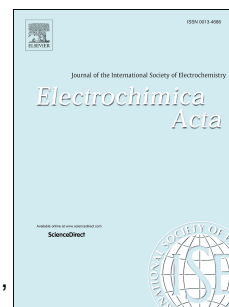
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# 1 Improving the electrochemical properties of MXene $\text{Ti}_3\text{C}_2$ multilayer 2 for Li-ion batteries by vacuum calcination

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8 **Abstract:** The electrochemical properties of MXene  $\text{Ti}_3\text{C}_2$  multilayer for Li-ion  
9 batteries were improved greatly by vacuum calcination, after systematically  
10 evaluating its thermal stability in different atmosphere in details. In air, the as-  
11 prepared  $\text{Ti}_3\text{C}_2$  could not be oxidized up to 429.9 °C and the rutile- $\text{TiO}_2$  would remain  
12 as the oxidation product at 1200 °C. The surface functional groups especially F groups  
13 can be eliminated by heat treatment. After vacuum calcination at 400 °C, the  $\text{Ti}_3\text{C}_2$   
14 show much higher capacities due to the removal of OH groups (126.4 mAh·g<sup>-1</sup> at 1C),  
15 and exhibited excellent rate capability. Besides, the formation of  $\text{TiO}_2$  nanoparticles at  
16 700 °C further increases the first coulombic efficiency (62%) and capacity retention  
17 after 100 cycles (97%). In contrast, the dense microstructures of resulting  $\text{TiC}_x$   
18 formed after calcination at 1000 °C results in the worst electrochemical properties.  
19 This paper presented a relatively simple and easily scalable post-treatment for  
20 improving the electrochemical properties of MXene, and demonstrated a great  
21 potential of  $\text{Ti}_3\text{C}_2$  of using as anode material for Li-ion batteries.

22 **Keywords:** Thermal stability; Multilayer  $\text{Ti}_3\text{C}_2$ ; Vacuum calcination; Electrochemical  
23 properties; Li-ion batteries

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