**Crosslinked Carboxymethyl Cellulose−Polyethylene Glycol Binder for the Improved Cycle Performance of Silicon Anodes in Li−Ion Batteries**

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**Highlights**

* A facile in situ crosslinked binder system is proposed by a convenient, environmental-friendly and low-cost methodology for the practical use.
* The silicon anode prepared with the CMC-PEG binder shows stable cycling performances as lithium-ion batteries.

**1. Introduction**

Silicon has been widely studied due to its relative abundance and high theoretical specific capacity (~3572 mAh g−1) as an anode material for lithium ion batteries (LIBs). However, the drastic volume changes up to 300% associated with Li still hinder the practical implementation of Si. Herein, we report an in situ cross-linked carboxymethyl cellulose-polyethylene glycol (CMC-PEG) binder and its application to the silicon anode for the long-term cycle life of LIBs. potential to be used for Si and other active materials experiencing volume expansion for LIBs.

**2. Methods**

For slurry preparation of the reference electrode with CMC, silicon , conducting carbon, CMC, and SBR were placed into deionized water in a weight ratio of 85 : 5 : 8 : 2. For slurry preparation of the electrode prepared with the crosslinked CMC-PEG binder, silicon, conducting carbon, CMC, PEGDE, and SBR were placed into deionized water in a weight ratio of 85 : 5 : 6.4 : 1.6 : 2.

**3. Results and discussion**



**Figure 1.** Cycling performance of the silicon electrodes prepared with CMC and crosslinked CMC-PEG binders at 0.5 C rate.

The crosslinked CMC-PEG binder is simply prepared during the electrode drying process without an additional process. In particular, the crosslinked CMC-PEG binder enables the improved and adhesion between active materials and a current collector, and cohesion between active materials. The silicon anode prepared with the crosslinked CMC-PEG binder exhibits stable cycling performance with a capacity of ∼2000 mAh g−1 over 300 cycles.

**4. Conclusions**

Crosslinked CMC-PEG binder was prepared by a facile and low-cost approach. The silicon electrode prepared with the CMC-PEG binder exhibited outstanding cycle performance over 300 cycles at 0.5 C. In terms of the simplicity, in situ crosslinked CMC-PEG binder has a potential to be applied to the silicon anodes for stable cycle performance of LIBs.