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Potential Alternatives for Advanced Energy Material Processing in High Performance Li-ion Batteries (LIBs) via Atmospheric Pressure Plasma Treatment JENQ-GONG DUH, SHANG-I CHUANG, CHUN-KAI LAN, HAO YANG, HSIEN-WEI CHEN, National Tsing Hua University, Hsinchu, Taiwan — A new processing technique by atmospheric pressure plasma (APP) jet treatment of LIBs was introduced. Ar/N_2 plasma enhanced the high-rate anode performance of $Li_4Ti_5O_{12}$. Oxygen vacancies were discovered and nitrogen doping were achieved by the surface reaction between pristine $Li_4Ti_5O_{12}$ and plasma reactive species (N^* and N_2^+). Electrochemical impedance spectra confirm that plasma modification increases Li ions diffusivity and reduces internal charge-transfer resistance, leading to a superior capacity (132 mAh/g) and excellent stability with negligible capacity decay over 100 cycles under 10C rate. Besides 2D material surface treatment, a specially designed APP generator that are feasible to modify 3D TiO_2 powders is proposed. The rate capacity of 20 min plasma treated TiO_2 exhibited 20% increment. Plasma diagnosis revealed that excited Ar and N_2 was contributed to TiO_2 surface reduction as companied by formation of oxygen vacancy. A higher amount of oxygen vacancy increased the chance for excited nitrogen doped onto surface of TiO_2 particle. These findings promote the understanding of APP on processing anode materials in high performance LIBs.

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