# Facile synthesis of recycled silicon/carbon porous composites via rapid thermal process for lithium-ion battery anode

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A tremendous quantity of waste sludge is generated through silicon wafers slicing process from the semiconductor and photovoltaic industries in Taiwan. Converting the waste sludge into high-value products is strategically important for industrial processes. Herein, the purified Si micro-particles are recycled from the waste sludge to realize into lithium-ion battery. However, a crucial issue to delay the developing silicon anode is large volume expansion during cycling, diminishing the capacity of the battery. In this study, Rapid Thermal Process is introduced in Si-based electrodes to mitigate the volume change of Si anode. This strategy provides buffer space, which is constructed via in-situ cross-linked aqueous binder to form carbon porous continuous conductive framework. This innovative design not only ameliorates local stress but also stabilizes the solid electrolyte interphases formation of micro-sized silicon particles. This Silicon/carbon composite anode shows a reversible capacity over 1700 $mAhg^{-1}$ after 30 cycles at 0.5 $Ag^{-1}$, and superior rate capability. Furthermore, on the basis of these advantages, including low cost, facile manufacture, and high performance, this approach provides a pathway to achieve commercial high- capacity Silicon/carbon composite anodes for Lithium-ion batteries.

Keywords: waste silicon, rapid thermal process, aqueous binder