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# Electrocatalytic Amino Acid Synthesis from Biomass-Derivable Keto Acids over Ball-Milled Carbon Nanotubes

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**Abstract :** Electrocatalytic reductive amination (ERA) offers an attractive way to make organonitrogen chemicals from renewable feedstock. Here, we report carbon nanotube (CNT) as an effective catalyst for the ERA of biomass-derivable α-keto acids into amino acids using $NH_3$ as the nitrogen source. Through a facile ball milling (BM) treatment, the intrinsic defects in the CNTs were increased while the electrocatalytic activity of CNTs converting 2-ketoglutaric acid into glutamic acid was enhanced by approximately seven times. A high Faradaic efficiency (FE) of ~90% with a corresponding glutamic acid formation rate up to 180.9 $mmol•g^{-1}_{at}•h^{-1}$ was achieved, and ~60% molar yield of glutamic acid was obtained after 8 h of electrolysis. Electrokinetic analyses indicate that the BM-CNTs catalysed ERA exhibits first-order dependences on the substrate and $NH_3$, with a rate-determining step (RDS) involving the first electron transfer. Following this protocol, a number of amino acids were prepared with moderate to high FEs and formation rates. Significantly, we synthesised long carbon chain amino acids, which typically face lower yields using the existing methods.

**Keywords :** amino acids, carbon nanotubes, electrocatalysis, reductive amination, α-keto acids
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