

# Electrochemical oxidation of glucose on nitrogen-doped graphene over CrMnFeCoNi high entropy alloy

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## ABSTRACT

Accurate sensing of glucose is the first step towards monitoring and management of diabetes mellitus. The nonenzymatic partial electrochemical oxidation of glucose yields 1,5-gluconolactone. Herein, we investigate a hybrid structure composed of nitrogen-doped graphene layer over CrMnFeCoNi high entropy alloy for electrochemical oxidation of glucose for sensing application. The presence of nitrogen-doped graphene over cantor HEA inhibits the strong transition metal-oxygen interaction which prevents poisoning of the surface. Cantor alloy helps in providing stability to the three forms of nitrogen defects, graphitic, pyrrolic and pyridinic. The reaction was carried out on cantor alloy, nitrogen-doped graphene and hybrid structure to understand the activity of glucose adsorption on all three systems. Our results reflected the highest activity of glucose adsorption on hybrid structure with least bonding distance of 1.46 Å and adsorption energy of -1.09 eV. The theoretical insights provided by density functional theory has supported the experimental observation of HEA encapsulated carbon nanotube providing the excellent activity with pyrrolic nitrogen acting as the most prominent site of interaction for glucose sensing in the hybrid structure. Therefore, the suggested sensor is suitable for precise measurement of glucose levels in human serum and demonstrates consistent performance. This will establish a novel and economical HEA and graphene based heterostructure for diagnostic assessment and health tracking.

