






Improvement of the ability of graphene by simultaneous cobalt (Co) and nitrogen (N) doping as an electrode for supercapacitor application

Ming Ma ^a, Yathrib Ajaj ^b, Ali M. Hussein ^c, Anupam Yadav ^d  , Sherzod Abdullaev ^{e f}, Saad Khudhur Mohammed ^g, Hayder Sharif ^h, Bashar M. Al-khamiseh ⁱ, Yasser Elmasry ^j

Show more 

 Add to Mendeley  Share  Cite

<https://doi.org/10.1016/j.diamond.2024.110824> 

[Get rights and content](#) 

Abstract

Thanks to its high electronic conductance and large surface, many research studies have investigated the application of graphene (Gr) in supercapacitors as an electrode material. The properties of Gr can change efficiently through the doping of specific elements and by designing various morphologies. In the current piece of research, DFT calculations are undertaken to investigate the impact of doping cobalt (Co) and nitrogen (N) atoms, and a monovacancy (MV)-added Gr structure upon the quantum capacitance (QC), electronic attributes and stability. Based on the calculations, doping Co and N and the presence of the MV radically changed the QC of the electrode. Nevertheless, achieving structural stability can be a challenge. A high QC of $\sim 77 \mu\text{F}/\text{cm}^2$ was obtained in the Co—N₃ system by the association of N-doping and the existence of the MV. The present piece of research provides insights into the viable impact of combined doping upon increasing the QC of Gr-based electrodes.