

Preface Comments to Reviewer 1

To facilitate the understanding of our response to both the Reviewer 01 and the Reviewer 02, we first put in perspective negative-ion catalysis. The fundamental mechanism underlying atomic negative-ion catalysis was proposed by our group in the context of muon catalyzed nuclear fusion [<https://doi.org/10.1088/0953-4075/43/20/201001>; doi:10.1088/1742-6596/225/1/012002]. The mechanism involves anionic molecular complex formation in the transition state (TS), with the atomic negative-ion breaking the hydrogen bond strength. The mechanism has been demonstrated in the synthesis of H₂O₂ from H₂O catalyzed using the Au⁻ and Pd⁻ anions to understand the experiments of Hutchings and collaborators [<https://doi.org/10.1039/B705915A>; <https://doi.org/10.1039/B509542E>; DOI: 10.1126/science.aad5705], in the catalysis of light, intermediate and heavy water to the corresponding peroxides [<https://doi.org/10.1021/jp301861q>], in the oxidation of methane to methanol without the CO₂ emission [<https://doi.org/10.1007/s13404-012-0056-7>] and more recently, in the doubly-charged negative ions as novel tunable catalysts: graphene and fullerene molecules versus atomic metals [<https://doi.org/10.3390/ijms21186714>].

Reviewer 1

Response to 1

Simplified Title: Drone Delivery of Dehydro-Sulfurization Utilizing Doubly-Charged Negative Ions of Nanoscale Catalysts Inspired by the Biomimicry of Bee Species' Bio-Catalysis of Pollen Conversion to Organic Honey

Response to 2

The mechanism of "double-charge" ions utilizing potential catalysts presented in this work has been well established by the works James Tour wherefore application of electrostatic spark is most efficient in converting a plethora of organisms and compound directly to elemental or allotrope carbon. Given that electrostatic charge "in our case double charge negative ions" can be generated via nanoscale probes and other standard experimental tools we are presenting that there is further novelty in the application of these light-weighted materials to mobile approaches such as recent drone technology that has been developed.

Response to 3

The catalysts are well-established Carbon Allotropes of spherical, cylindrical, and planar geometry as well as planar MoS₂. The article is a comparative study of these geometrically and energetically distinct molecules and the Transition State energies as affected by the introduction of double charged negative ions.

Response to 4

We use the well-established H₂S oxidation to SO₂ in order to demonstrate that multi-step as well as direct path reaction mechanisms can actually be tuned or tailored to the most efficient energy barrier height depending on the catalyst used. In other words, It has been previously documented that the application of "doubly charged negative ions" to catalysts is efficacious for tuning direct path and multi-step reactions. We have further clarified the barrier heights and context of "elementary steps" by calculating the Standard reference for the reactions using "negative ion" only in order to indicated barrier percentages. While any further calculation is surely quantifiable, the negligible energy associated with these bond breakages occurring "at the peak" of the barriers result information that very qualifiable from a negative ion with double charge point of view. The percentage barrier changes are calculated with equation 5, and are presented in table I showing that the reaction barriers are increased in figure 3 by 92.6% and 73.2% for CNT (6,6) calculations of TS-1 and TS-2, respectively. Hence, CNT (6,6) catalysts are predicted to slow the rate of reaction as a substrate for desulfurization. However, MoS₂ is calculated to have a barrier increase of 70.5% for TS-1 and a barrier decrease of -10.2% as shown in figure 4 which indicates that MoS₂ is predicted to be an excellent accelerator of reaction for Step 2 of desulfurization. Figure 5 illuminates that Gr-28 tends to slow the desulfurization reaction by 32.7% and 74.5% for TS-1 and TS-2, respectively. C-60 is calculated to have the lowest reaction impedance of 25% for Step-1 as presented in Figure 6. However, for Step-2 the reaction barrier is reported to be 72.8%. Figure 8 shows the respective calculated transition state energies and geometrically optimized view of the catalysis steps when C-60 and MoS₂ catalysts are applied to Step-1 and Step-2 respectively. The two materials are predicted to effectively maintain or lower transition state barriers when applied sequentially. C-60 changes the barrier by 25%, whereas MoS₂ reduces the transition state energy by -10.4% according to Table 1. Figures 9-11 are geometrical optimizations of the pollen conversion to organic honey mechanism that honey bees use wherefore the enzymes invertase, amylase, glucose oxidase, and catalase are applied in nature for honey production. Similarly, the enzymes are initiated by the flow of 2e⁻. We therefore have applied two varying inorganic molecules to each step of the reaction rather than applying the catalysts uniformly to all steps. This approach may find efficacy in the optimization to a plethora of other multi-step reactions

5. Response to 5

The following references have been cited

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Response to 6

Images have been updated

