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| Book Name: | **Plasmas Afterglows with N2 for Surface Treatments synthesis 2024** |
| Manuscript Number: | **Ms\_BPR\_** **3686.3** |
| Title of the Manuscript: | **Active Species in Plasmas Produced by Microwave Cavities** |
| Type of the Article | **Book chapter** |

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| PART 1: Review Comments | | |
| Compulsory REVISION comments | Reviewer’s comment | Author’s Feedback *(Please correct the manuscript and highlight that part in the manuscript. It is mandatory that authors should write his/her feedback here)* |
| **Please write a few sentences regarding the importance of this manuscript for the scientific community. Why do you like (or dislike) this manuscript? A minimum of 3-4 sentences may be required for this part.** | **This manuscript focuses on the study of microwave plasmas across a range of gas pressures, from low to atmospheric, in rare gases (mainly argon) and nitrogen-containing gas mixtures, is of significant importance to the scientific community. These studies, initiated by Michel Moisan at the University of Montreal, have led to the development of patented launchers like Surfatron and Surfaguide, which are crucial for producing surface wave plasmas under different conditions, including the detection of active species using optical spectroscopy. This comprehensive research review enhances our knowledge of plasma physics and its practical applications, contributing to advancements in technology and industry.** |  |
| **Is the title of the article suitable?**  **(If not please suggest an alternative title)** | **Yes, "Active Species in Plasmas Produced by Microwave Cavities" is an appropriate title for the provided manuscript. The content focuses on the study of microwave plasmas across various gas pressures, the production of active species in these plasmas, and the use of optical spectroscopy to detect these species. The title effectively captures the essence of the research, highlighting the key aspect of active species in microwave-generated plasmas.** |  |
| Is the abstract of the article comprehensive? Do you suggest the addition (or deletion) of some points in this section? Please write your suggestions here. | **The flow of the abstract is generally coherent, but it could benefit from some minor adjustments for clarity and readability. It should clearly describe the content of the manuscript in short form without any references and may be in a single paragraph.** |  |
| **Are subsections and structure of the manuscript appropriate?** | **Yes.** |  |
| **Please write a few sentences regarding the scientific correctness of this manuscript. Why do you think that** **this manuscript is scientifically robust and technically sound? A minimum of 3-4 sentences may be required for this part.** | **The book chapter describes the study of microwave plasmas across a range of gas pressures, from low to atmospheric, using rare gases (mainly argon) and nitrogen-containing gas mixtures. Key points include:**  **1. Surface Wave Plasmas: At low gas pressures, surface wave plasmas are produced using patented launchers, Surfatron and Surfaguide, developed by Michel Moisan at the University of Montreal since 1975. These plasmas operate at low power for Surfatron and high power for Surfaguide at higher gas pressures.**  **2. Resonant Cavity: At higher gas pressures (from a few Torr to atmospheric), plasmas are also produced using a resonant cavity in nitrogen-oxygen mixtures (N2-xO2 with x=0-20%). The main frequency used is 2450 MHz, with plasma power ranging from a few watts to several kilowatts.**  **3. Optical Spectroscopy: Optical spectroscopy is used to detect plasma active species, initially focusing on the spatial distribution of radiative species in argon gas at low pressure. This technique helps characterize surface wave plasmas and obtain the radial distribution of argon metastable density through resonant optical absorption.**  **4. Active Species and Kinetics: At medium to atmospheric pressures, flowing high-frequency plasmas (resonant cavity) and surface wave plasmas in nitrogen mixtures produce nitrogen atoms and other active species like N2 metastable molecules and N2+ ions. The kinetics of reactions involving these species are studied, particularly their interference in radiative emissions.**  **5. Plasma Characteristics: At atmospheric pressure, plasmas are mainly in argon, which is easier to ionize. These plasmas are characterized by electron density and gas temperature, with variations depending on power, flow rates, and exit tube diameters. The plasmas' proximity to Local Thermodynamic Equilibrium (LTE) is demonstrated by studies at the University of Montreal, Lisbon IST, and Cordoba University.**  **This comprehensive study highlights the versatility and complexity of microwave plasmas across different conditions and their applications in various fields. This indicates that the manuscript is scientifically robust and technically sound.** |  |
| **Are the references sufficient and recent? If you have suggestions of additional references, please mention them in the review form.**  **-** | **The references are not sufficient and recent. The references listed span a wide range of years, from as early as 1959 to as recent as 2020. Here is a breakdown of the publication years for each reference:**   1. **1975** 2. **1977** 3. **1983** 4. **1983** 5. **1977** 6. **1959** 7. **2011** 8. **1970** 9. **1977** 10. **1977** 11. **1979** 12. **2020** 13. **1998** 14. **1999** 15. **1979** 16. **1988** 17. **1994** 18. **1995** 19. **2010** 20. **2015**   **As you can see, while some references are quite recent (e.g., 2011, 2020, 2010, 2015), many of them are older, dating back to the 1970s and 1980s. Therefore, adding recent references in the right places are highly recommended.** |  |
| Minor REVISION commentsIs the language/English quality of the article suitable for scholarly communications? | It needs revision. Specially, the paragraphs are too fragmented, and the figures legends are not written according to the standard format. For example, Fig. 3.13a and Fig. 3.13b; Fig. 3.19a and Fig. 3.19b; Fig. 3.23a and Fig. 3.23b are not correct. Just write Figure 3.13 (a) and (b). |  |
| Optional/General comments | It would be better to add several challenges in this manuscript associated with active species in plasmas produced by microwave cavities:  Control of Plasma Parameters: Achieving precise control over plasma parameters such as power, pressure, and gas flow rates is crucial for consistent production of active species. Variations in these parameters can lead to fluctuations in the density and distribution of active species.  Detection and Measurement: Accurately detecting and measuring active species within the plasma can be challenging. Techniques like optical spectroscopy are used, but they require sophisticated equipment and expertise to interpret the results.  Reactivity and Stability: Active species are often highly reactive and have short lifetimes, making it difficult to maintain their stability for extended periods. This can impact their effectiveness in applications such as surface treatments and biomedical uses.  Interaction with Surroundings: The interaction of active species with the surrounding environment, including the plasma chamber walls and any materials being treated, can affect their behavior and efficiency. This requires careful design and material selection for the plasma setup.  Scalability: Scaling up the production of active species for industrial applications while maintaining control over plasma parameters and species distribution is a significant challenge. This involves addressing issues related to power supply, cooling, and uniformity of the plasma.  Addressing these challenges requires ongoing research and development to optimize plasma generation techniques and improve the understanding of plasma behavior. |  |

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| **PART 2:** | | |
|  | **Reviewer’s comment** | **Author’s comment** *(if agreed with reviewer, correct the manuscript and highlight that part in the manuscript. It is mandatory that authors should write his/her feedback here)* |
| **Are there ethical issues in this manuscript?** | *(If yes, Kindly please write down the ethical issues here in details)* |  |

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