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| Book Name: | [**Chemical and Materials Sciences: Developments and Innovations**](https://www.bookpi.org/bookstore/product/chemical-and-materials-sciences-developments-and-innovations-vol-1/) |
| Manuscript Number: | **Ms\_BPR\_4326** |
| Title of the Manuscript: | **Formation of Al2O3-HfO2 Eutectic EBC Film on Silicon Carbide Substrate** |
| Type of the Article | **Book Chapter** |

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| PART 1: 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. A minimumof 3-4 sentences may be required for this part.** | This manuscript contributes significantly to the scientific community by addressing the challenges in creating robust Environmental Barrier Coating (EBC) layers for silicon carbide ceramics, a key material in high-temperature applications like gas turbines. It explores the formation and preparation of Al2O3-HfO2 eutectic structures, which offer excellent oxidation and water vapor corrosion resistance. The study introduces an innovative optical zone melting method to produce high-density, functionally graded EBC layers with improved adhesion and structural integrity. These findings pave the way for advancements in materials engineering, particularly in enhancing the durability and performance of non-oxide ceramics in extreme environments. |  |
| **Is the title of the article suitable?**  **(If not please suggest an alternative title)** | **Yes** |  |
| 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 abstract should explicitly state the research objective or the specific question being addressed to provide readers with a clear understanding of the study's focus.** |  |
| **Is the manuscript scientifically, correct? Please write here.** | **Yes** |  |
| **Are the references sufficient and recent? If you have suggestions of additional references, please mention them in the review form.**  **-** | **Yes** |  |
| Is the language/English quality of the article suitable for scholarly communications? | Certain technical terms might require additional explanations or contextualization for interdisciplinary audiences. |  |
| Optional/Generalcomments | The present study focuses on the “**Formation of Al2O3-HfO2 Eutectic EBC Film on Silicon Carbide Substrate”**. The structure of the paper is well organized.  1. SEM images clearly shows presence of HfO₂ appeared as the white phase and Al₂O₃ appeared as the dark phase.  2. The **controlled solidification rates** and use of advanced tools like Raman spectroscopy and SEM provided significant insight into the correlation between solidification rate and microstructure evolution  3. The **relationship between interlamellar spacing and solidification rate** highlights the predictable nature of eutectic growth in such systems, confirming the trends observed in similar eutectics like Al₂O₃-ZrO₂.  4. This work adds valuable data on how processing parameters influence the microstructure of Al₂O₃-HfO₂ eutectics, reinforcing its potential as a robust material for high-temperature applications.  5. In the case of **Al₂O₃-HfO₂ eutectics**, only a lamellar structure forms, even under rapid solidification conditions.  6. According to the **Jackson-Hunt theory**, the relationship between interlamellar spacing (λ) and solidification rate (R) follows eutectic growth dynamics.  7. The substrate (silicon carbide bulk) and its composition (containing carbon and boron as sintering agents) are clearly identified.  8. The suggestion to apply a rapid heating process for creating a multilayered EBC film demonstrates a forward-thinking solution to overcome the issues encountered.  9. The experimental procedures, including the optical floating zone apparatus and its operation, are well-detailed.  10. Figures and corresponding XRD/SEM analysis are referenced to support the conclusions, making the results more credible.  11. The four-step process for forming the Al₂O₃-HfO₂ eutectic film is presented logically, offering a clear overview of the mechanism.  Apart from these, there are some minor changes needed:  **Suggestions for Improvement**  1. This mechanism demonstrates how the interactions between the substrate, molten phases, and high-temperature reactions contribute to the formation of a graded and well-adhered EBC layer.  2. What is role of the HfO₂ phase or more on the apparatus used?  3. Ensure that the XRD results are analyzed comprehensively, connecting them to the solidification behavior and microstructure.  4. Eliminate repetitive phrases and restructure sentences for improved clarity and flow.  5. There is no mention of the thickness or uniformity of the applied slurry or the resulting film after heat treatment.  6. The text mentions Jackson-Hunt theory but does not elaborate on how the relationship between λ and R is derived or observed experimentally. Adding this context would clarify the theoretical framework.  7. Are there any secondary phases present in the description of the XRD results.  8. How would rapid heating prevent the complete vaporization of Al₂O₃?  9. The text notes that the process must be performed quickly to avoid excessive carbon generation but provides no suggestions for optimizing this.  10. While the absence of cracks is noted, the mechanical properties of the intermediate and eutectic layers are not discussed. Including a comment on their durability or thermal cycling performance would strengthen the section.  11. Avoid repetitive Use of "Phase". |  |

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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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| **Reviewer Details:** | |
| Name: | **Balaraj V** |
| Department, University & Country | **Rao Bahadur Y. Mahabaleswarappa Engineering College Vijaya Nagar, India** |