Structural Characterization of Perovskite Semiconductors "Self-Healing" Under Simulated Space Conditions

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Introduction

Research Question:
How does the structural healing properties of perovskite semiconductors vary with composition after exposure to simulated space conditions?

Objective:
Characterize the structural properties of perovskite materials (CsPbBr3 composition with varying starch percentages) that have experienced simulated irradiation to better understand their healing properties and performance in space applications.

Procedure

1. Structurally characterize the four CsPbBr3 samples before irradiation using X-Ray Diffraction (XRD)
2. Expose the 4 samples to gamma radiation (1 MRad)
3. Immediately characterize the samples after gamma irradiation using XRD
4. Allow samples to rest without exposure for 3-4 weeks
5. After the 3-4 weeks of rest, characterize the samples using XRD
6. Gather results from collected data and identify the structural change between each phase of exposure and rest

Data/Results

Figure 1

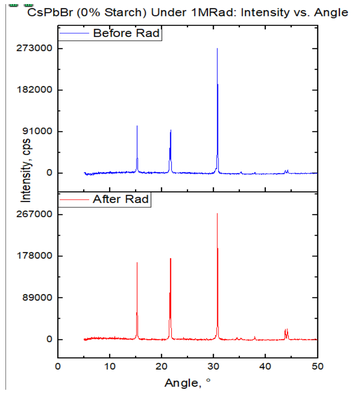


Figure 2

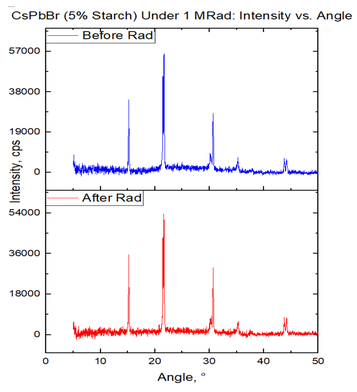


Figure 3

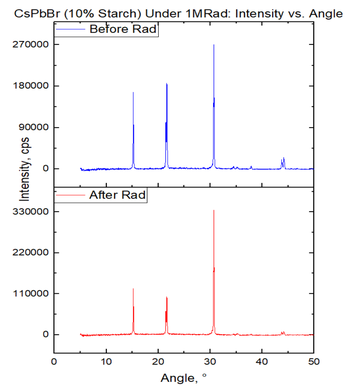
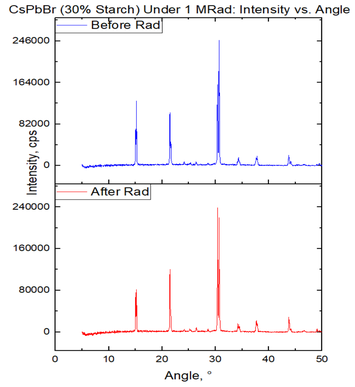


Figure 4



Results Immediately After Exposure:
From Figures 1, 2 ,3, and 4, all samples experienced little structural change after irradiation, as shown by the peaks of the graphs. For the plain sample (Figure 1), the semiconductor gained an increase in depth between the crystalline's layers. On the other hand, the samples with 10% and 30% starch (Figures 2 & 3), decreased in layer depth.

Next Steps

Perform XRD:
Once the samples have rested for 3-4 weeks, XRD will be performed to identify the self-healing properties of the perovskite material, if any.

Analyze:
Once data is collected and results have been processed, the next step is to determine the effect of starch on the semiconductors, and deduct if it enhances, diminishes, or has no effect on the semiconductor's healing properties Additionally, analyzing the effect of the starch will determine if it aids in other aspects of the perovskite, such as its endurance and resilience against moisture and extreme temperatures.

References

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