**Authors’ response to Reviewer’s comments**

The authors wish to thank the reviewers and the editor for their valuable comments/suggestions to enhance the quality of the manuscript. We have addressed the reviewer’s comments/suggestions, listed our point-by-point response to the reviewer’s comments below, and highlighted all changes to the manuscript in yellow.

**Reviewer #1**

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| **Reviewer Comment:** This paper provides a detailed analytical study with a combination of experimentally (in-situ imaging, FIB-SEM) and thermal modelling based investigations into the novel Self-Propagating Exothermic Reactive (SPER) bonding and results in five conclusions. The main contributions are (1) the revealing of void formation mechanisms, and (2) demonstrating the influence of bonding substrate on the reliability of SPER interconnects. Those discoveries are novel for both an academic audience as well as the electronic packaging industry and could not be revealed without the synchrotron in-situ imaging technique used for the experiments.  **Authors Response:** We appreciate the reviewer for recognising the novelty of the work that we have presented in the paper. |
| **Reviewer Comment #1:** In the introduction, the authors mentioned "This ultrafast reactive bonding technique will result in a sound interfacial bond with a narrow heat-affected zone (HAZ) [4]." The reviewer read in detail the references [4], and term of "heat-affected zone (HAZ)" could not been found. HAZ is usually used in welding process but not soldering or blazing process and it may lead to some confusion. Please check the definition of HAZ and consider rephrasing.  **Authors Response #1:** We apologise for any confusion. The word “narrow heat-affected zone (HAZ)” has been replaced with “minimal thermal effects”. This update has been highlighted on Page 2 of the revised manuscript. |
| **Reviewer Comment #2:** In the experimental methods, "tin-silver-copper (SAC) 305" should be accompanied by a chemical analysis/composition.  **Authors Response #2:** The compositional information of SAC 305 has been included on Page 4 of the revised manuscript. |
| **Reviewer Comment #3:** Experimental results indicate three decimal points accuracy (e.g. t=0.267 ms in Figure 3), while time resolution (frame rate) of in-situ imaging is two decimal points (0.24 ms). Therefore, all time frames in the imaging data (in Figure 3-5 and descriptions in the article) need to be corrected or justification of the accuracy of the time should be included.  **Authors Response #3:** We apologise for the confusion. The 0.240 ms mentioned in the manuscript is the exposure time of the X-ray detector (camera). There is a 0.027 ms dark time between frames giving a frame rate of 3745 Hz (i.e. 3745 frames per second, (1/3745) = 0.267 ms between the start of two frames). We have clarified this in the revised text. |
| **Reviewer Comment #4:** While the five doted conclusions are substantiated by the experimental results and discussion, they could be made present, shorten and clearer. As described in the abstract, the reviewer believes the novelty/contribution of this article is (1) revealing the void formation mechanisms, and (2) demonstrating the influence of the substrate on the reliability of SPER interconnects.  **Authors Response #4:** The conclusions (Pages 20 & 21) of the manuscript have been revised according to the reviewer’s suggestions. |
| **Reviewer Comment #5:** The three supplementary videos, currently showing raw data, need scale bars but the reviewer recommend adding an indication for each of the main reaction events and joint components materials. This would make the videos more easily interpreted.  **Authors Response #5:** The three supplementary videos have been annotated as per the reviewer’s suggestions, and a supplementary text file is also added to provide further details of the content of the supplementary videos. |

**Reviewer #2**

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| **Reviewer Comment #1:** This manuscript is not suitable for publication in Acta Materialia. The topic is relevant, and there has been only limited of fast x-ray imaging to study self-propagating reactions in multilayer foils, and no (so far as I am aware) in situ studies of bonding using these reactions, so there is some novelty. However, the bulk of the manuscript is merely a qualitative description of the three x-ray movies, corresponding to three different types of samples. The remainder is mostly an analysis of the post-bonding microstructure, which is not especially novel. But the biggest drawback is that there is very little physical insight obtained; most of the manuscript is merely a listing of observations. As such, while there is nothing particularly wrong with it and it certainly could be published in a lower-tier journal, it does not rise to the level that I expect for publication in Acta.  **Authors Response #1:** We believe that the novelty of the paper is indeed in the insights gained from the in situ work as recognised by the other referee and which we have clarified in our revised text. We hope that these revisions enable the paper to be published in Materialia as recommended by the editor. |