

## ***Interactive comment on “Experimental study on the electrical conductivity of quartz andesite at high temperature and high pressure: evidence of grain boundary transport” by K. S. Hui et al.***

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**General Comments** This paper compiles data of an experimental study on electrical properties of quartz-andesite. The measurements were performed under elevated pressure and temperature conditions and in a wide frequency range. The overall impression is that the experiments have a solid basis, but details on the experimental setup, collection of data and the interpretation are missing and should be included in the revised version of the paper. This paper is appropriate for publication in SE after revision, it fits to the scope of this journal.

The paper is written in poor English, the diction should be corrected by an expert. This

C763

would enhance the scientific value of the paper significantly. The present version of the paper does not offer an easy access to a reader not familiar with the experimental procedure and interpretation of the data. I suggest that the authors should include in the revised version more details on the low frequency part of the frequency spectrum (details see below). This is essential for an understanding of the low frequency response and its interpretation in terms of conduction mechanisms.

**Specific Comments** 135: Ni- electrodes are mentioned in the text, Pt- electrodes in Figure 1 147-151, Fig 2: the high frequency response can be described by an RC-element as it was done in this study, but the low frequency end looks more like a Warburg impedance thus reflecting reactions at the electrodes rather than typical RC-response. This should be outlined more clearly. 166: definition of R. The equation converts measured impedances into specific properties, was this done for each individual conduction process, or the overall bulk conductivity. 183: What do you mean with this sentence, explain in more detail. 192: (Figure 4) or table 2? ground boundary – mistyping for grain... 195-196: a further table summarizing  $\sigma_{gi}$  and  $\sigma_{gb}$  would be helpful for the reader to follow the argumentation of the authors. 223-227: Explain in more detail what is the sense of the comparison of thermally activated semi-conduction with those of partially molten samples. Was an optical inspection of partial melting performed? 230-236: This paragraph needs more explanation. If polaron conduction is assumed to be the principle conduction process, then redox reactions at the electrodes have to be considered especially in the low frequency region of the spectrum. What is the contribution of the alkali? 242: Reference: Dai and Karato 2014 a,b 240-250: Oxygen fugacity: Due to the experimental setup (MgO and Ni-foil) the  $f_{O_2}$  concentration of ferric iron is rather low. Estimated or measured oxygen partial pressure? Figure 3: Scaling of the y-axis kOhm or Ohm? Figure 5: Considering the shape of the Cole-Cole-Plots grain interior conduction is more than twice as high than grain boundary conduction. This is not reflected in Figures 4 and 5, these diagrams suggest that  $\sigma_{gi}$  and  $\sigma_{gb}$  conductivity are of the same value. Figure 6: What is the definition of total conductivity, is this the equivalent of bulk-conductivity? Figure 7: Urgently needs

C764

a more detailed definition in the figure captions to be understandable for the reader. This holds for all figure captions. References: Check references

Does the paper address relevant scientific questions within the scope of SE? yes Does the paper present novel concepts, ideas, tools, or data? no Are substantial conclusions reached? Not really, should be more specific Are the scientific methods and assumptions valid and clearly outlined? Yes, but hard to understand due to diction. Are the results sufficient to support the interpretations and conclusions? Except for fO<sub>2</sub>, yes Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? no Do the authors give proper credit to related work and clearly indicate their own new/original contribution? yes Does the title clearly reflect the contents of the paper? Yes Does the abstract provide a concise and complete summary? yes Is the overall presentation well structured and clear? yes Is the language fluent and precise? No A principle concern on this paper is the quality of the english diction. It must be corrected. A reader non familiar with the used techniques cannot easily follow the argumentation of the authors. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? yes Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? Yes, more details in the experimental and discussion section of the paper. Are the number and quality of references appropriate? yes Is the amount and quality of supplementary material appropriate? yes

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C765