Reply to "Comment on 'Mobility spectrum computational analysis using a maximum entropy approach' "

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In their Comment [J. Antoszewski, D. D. Redfern, L. Faraone, J. R. Meyer, I. Vurgaftman, and J. Lindemuth, Phys. Rev. E **69**, 038701 (2004)] on our paper [S. Kiatgamolchai, M. Myronov, O. A. Mironov, V. G. Kantser, E. H. C. Parker, and T. E. Whall, Phys. Rev. E **66**, 036705 (2002)] the authors present computational results obtained with the improved quantitative mobility spectrum analysis technique implemented in the commercial software of Lake Shore Cryotronics. We suggest that this is just information additional to the mobility spectrum analysis (MSA) in general without any direct relation to our maximum entropy MSA (ME-MSA) algorithm.

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We were very careful in writing our paper [1] to clearly distinguish QMSA (quantitative mobility spectrum analysis) from improved QMSA (*i*-QMSA) ([1], p. 036705-3), and to ensure that we used the correct references for QMSA [2] and *i*-QMSA [3]. We did not compare our result with that from *i*-QMSA because we could neither reproduce the *i*-QMSA software based on information in reference [3] nor purchase such a commercial software package (*c*-QMSA) from Lake Shore Cryotronics. We believe that most readers can distinguish these and the Comment [4] is just information additional to the mobility spectrum analysis in general.

Lake Shore Cryotronics did supply us with a demonstration version of the *c*-QMSA software [5]. However, we were unable to evaluate this since, even in the simplest case of two carrier types with zero random error mentioned in the Comment [4], no reasonable solution resulted.

To avoid further misunderstanding of the various interpretations of the QMSA abbreviation, we suggest very useful the following chronological description for mobility spectrum analysis and list the main advantages and disadvantages of each method.

Maximum entropy mobility spectrum analysis (ME-MSA) [1]

Advantages: (i) no inter/extrapolation is required; (ii) gives a smoother spectrum; (iii) less sensitivity to experimental error, higher sensitivity to low-mobility carrier; (iv) conductivity is always positive; (v) no empirical manipulation procedure; (vi) produces a unique spectrum which is not an envelope; (vii) uses all available experimental data points.

Disadvantage: further investigation and user's comments are needed.

Commercial quantitative mobility spectrum analysis (*c*-QMSA) [5]

Advantages and disadvantages: further investigation is needed due to nonavailability of *c*-QMSA in the public domain at the moment.

Improved quantitative mobility spectrum analysis (*i*-QMSA) [3,6]

Advantages: improves the fit over QMSA method.

Disadvantages: empirical manipulation procedures are likely to be case-specific and difficult to implement.

Iterative technique [7] and quantitative mobility spectrum analysis (QMSA) [2]

Advantages: (i) produces a unique spectrum which is not an envelope; (ii) use all available data points.

Disadvantages: (i) interpolation/extrapolation of data points are required; (ii) low sensitivity to low-mobility carrier; (iii) negative conductivity could occur; (iv) mirror/ghost peak effect; (v) peak breaking due to experimental errors.

Beck and Anderson analysis (MSA) [8]

Advantages: (i) high sensitivity to low mobility carrier; (ii) require a few data points, typically between 2-6.

Disadvantages: (i) no unique spectrum if there are high numbers of data points from which 2-6 data points are to be chosen; (ii) the spectrum is an envelope, an upper bound of all possible spectra.

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