Referee Report on Shavelzon and Ederly, "Shannon entropy of Transport Self-Organization Due to Dissolution/Precipitation Reaction at Varying Peclet Number in an Initially homogeneous Porous Media," submitted for publication in HESS.

I found this manuscript very interesting. Th use of Shannon entropy to measure emergent structures is nice and makes sense. The manuscript is well written and easy to follow, even for those that do not have a background in statistical physics.

The way that the Shannon entropy is measured does not consider spatial correlations. It is therefore an incomplete measure of this entropy. It is equivalent to measuring the Shannon entropy of a language based solely on the frequency of its use of each letter, thus missing the information attached to larger correlated structures such as the appearance of the letter "q" almost always being followed by the letter "u." Hence, the measurement of the Shannon entropy is incomplete. It is, however, probably a good first approximation to it.

I disagree with the arguments that internal and external entropy should add up to zero. There is viscosity in the system and total entropy, both from the emerging structures and that attached to the microscopic flow, is being produced continuously. The information entropy, which reflects macroscopic structures, is a very small part of the entire entropy budget, so the connection between the two is tenuous. The increase in conductivity as the dissolution process proceeds leads to an increase in entropy *production*. That is not the same as there is an increase in entropy as the entropy leaks away from the system in the form of heat, and this also increases.

A recent paper considers Shannon entropy in connection with immiscible two-phase flow in porous media, defining it in a way similar to that of Equation (13) in the manuscript, see https://doi.org/10.1016/j.advwatres.2022.104336. However, rather than connecting the information entropy to the molecular entropy, these authors build a statistical mechanics around it. I believe that the same ideas would be applicable in the present manuscript.

Despite my disagreement with the analysis of the authors with respect to the entropy budget, I will endorse publication. However, the authors should address my concern.