Measurement of emissivity using emissometers AERC/CGDB ILC 2025

This is a copy of an adjustment that happened during the 2017 ILC. The workbook used back then has not been modified specifically to this 2025 exercise but provided as a tool to help you report the best IR properties you can. Due to the calculation of emissivity and transmittance from the measurements on different backing being difficult for small values of transmittance it might need some judgment to decide a sample is TIR 0 even though you might not have identical values with both backings (which would theoretically happen and if you measure enough times). It is a tall order trying to find T^2 e.g. order of 0.0001 for a 1% transmittance sample in measured values with precision of 0.001 for my D&S AE1. So use your judgement for if the calculated TIR is more reasonable than TIR = 0 rather than blindly trusting the spreadsheet. The comments below are verbatim from 2017 and provided for additional context.

The results for solar-optical measurements were in better agreement than expected but the emissivity results are not as good as expected. Some submitters had TIR =0 for all samples which should not be the case, however, only correcting that would not resolve all the variation.

After doing internal tests at LBNL I believe that requiring the emissivity measurements to follow the procedure used for solar-optical properties of sample 3, i.e. measure at least 3 times, calculate standard deviation, and if not good enough, measure more times. The workbook is set up for you to fill out the measured apparent emissivities, and for now this is what we will have to use for the standard deviation calculation. I am worried that for samples with very low TIR, the variation in TIR is much higher than the variation in

In addition to adding more columns for measurements, I have also created separate lines depending on which backing material the sample was measured on. This was specified in AERC 1.1 appendix E and I was hoping that this would be followed and that the reported value would be the solution of equation (2) in section 2.1.2. The backing materials should ideally have high thermal conductivity and be flat, personally I use the calibration discs that come with the D&S AE1.

In hindsight I should have included a homogenous material, but I realized that the lid of the box that the samples came in should be uniform, so I added that as an extra sample to measure.

I have prepared a new workbook and attached it. I expect you to fill out cells B1 to B4 in the information sheet, B1 to B2 and D5 to at least F18 in the raw data sheet. Note that I filled out values just to verify that the calculations seem reasonable.

Simon Vidanovic wrote a numeric solver, and I included that in the workbook. You can see how it gets the raw data, iterates for a solution of the equation system and comes up with an answer. In theory you should not have to enter anything into the “Solve*”-sheets, but if there is no convergence, you can go in and try to change the default starting values (Es_ini, Ts_ini). As shown in the attached powerpoint, I should ideally have calculated TIR and Es for each combination of Ea1 and Ea2 to get a more interesting value of the standard deviation to track. If you are good at Excel and remakes the workbook to show that, I would be very happy to get a copy of it.