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CORRECTION

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Correction: Decoding recombination dynamics in perovskite solar cells: an in-depth critical review

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Correction for 'Decoding recombination dynamics in perovskite solar cells: an in-depth critical review' by Ramkrishna Das Adhikari *et al.*, *Chem. Soc. Rev.*, 2025, **54**, 3962–4034, https://doi.org/10.1039/D4CS01231C.

The authors regret that there were errors in some of the equations.

The inline equation on page 3964 should read $qV_{OC} = (dG/dN) = E_{fn} - E_{fp}$

Some fundamental underlying context and associated references were omitted in relation to the standard SQ fill factor (FF) approximation detailed in eqn (12) (in 'Section 2.2. SQ efficiency limit: the ultimate'). The equation presented assumes idealised conditions such as no shunt or series resistance (ideal diode behaviour) and therefore it is necessary to clarify the limits of this formula:

Under open-circuit conditions, where no external current is drawn, the QFLS directly corresponds to the qV_{OC}^{SQ}. This parameter quantifies the deviation of photogenerated carrier densities from their equilibrium values in the absence of illumination. The extent to which a solar cell can maintain a rectifying behaviour in its *J*–*V* characteristics is primarily determined by the FF. To approximate the FF under ideal conditions, we employ the analytic empirical expression derived by Martin A. Green, given as:[1,2]

$$FF^{SQ} = \frac{\frac{qV_{OC}^{SQ}}{k_B T} - \ln\left(\left(\frac{qV_{OC}^{SQ}}{k_B T}\right) + 0.72\right)}{\left(\frac{qV_{OC}^{SQ}}{k_B T}\right) + 1} \quad (12)$$

This formula assumes ideal diode behavior with an ideality factor of unity ($n = 1$), negligible series resistance and shunt resistance, and operation under steady-state, with one-sun illumination at constant temperature. These idealized conditions ensure that the FF depends only on the normalized open-circuit voltage $v_{OC} = \frac{qV_{OC}^{SQ}}{k_B T}$, and no parasitic electrical or optical losses are considered. It is important to note that eqn (12) is most accurate to one digit in the fourth significant place for operating at sufficiently large V_{OC}^{SQ} values $\left(v_{OC} = \frac{qV_{OC}^{SQ}}{k_B T} > 10\right)$ in high-quality solar cells.

Due to the debate surrounding eqn (22), specifically its lack of clear derivation or citation and the potential for perpetuating further misunderstanding, Section 2.4 "A bit of theory: thermodynamic correlation with V_{OC}", including eqn (22), should be deleted.

Portions of eqn (32) and eqn (9) contained incorrect signs. Eqn (32) should be given as

$$eV_{OC} = E_g + k_B T \ln\left(\frac{n}{N_C}\right) + k_B T \ln\left(\frac{p}{N_v}\right) = E_{Fn} - E_{Fp} \quad (32)$$

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Eqn (9) should be given as

$$F_S - F_C(V) + R(0) - R(V) - J/q = 0 \quad (9)$$

On page 3968, in the sentence ''However, the state-of-the-art PSCs have lower V_{OC} deficits than OSCs and DSSCs but are higher than GaAs and GaInP solar cells, nearing the V_{OC} radiative limit (Fig. 2b)'', Fig. 2d should be cited instead of Fig. 2b.

On page 3970, in the sentence ''However, practical solar cell devices exhibit a power-law relationship with light intensity, as demonstrated in the studies conducted by Caprioglio *et al.* Their investigations into PSCs utilizing poly(3-hexylthiophene-2,5-diyl) (P3HT) or poly(triaryl)amine (PTAA) as a hole transport layer (HTL) reveal a clear dependence on illumination intensity, expressed as PLQY(I) $\propto I^k$, where $k < 1$.[66]'', reference 61 should be cited and not reference 66.

On page 3982, a citation to ref. 3 should be added at the end of the sentence beginning ''This trap assisted monomolecular recombination...''.

On page 3991, in the sentence beginning ''Thus, eqn (29) is revised to the following equation...'', eqn (29) should be corrected to eqn (27).

The acknowledgements in the captions to Fig. 3c, 5b, 5c, 6b, 7c, 8d and e, 10e, 12f, 13c and d, 14e, 17h, 18b, 18e–g, 20a, 20b, 26c and d, 27c and d, 28b, 28c, 30f–i, 40a, 40d, and 41a–f should read ''Reproduced with permission from [reference] and used under the terms of the Creative Commons CC-BY licence''.

An independent expert has viewed the corrected equations and discussion and has approved the changes above.

The Royal Society of Chemistry apologises for these errors and any consequent inconvenience to authors and readers.

References

1 M. A. Green, *Solid State Electron.*, 1981, **24**, 788–789.
2 M. A. Green, *Solar Cells: Operating Principles, Technology, and System Applications*, Prentice Hall, Englewood Cliffs, NJ, 1982, Chap. 5, 85–102.
3 D. Głowienka, D. Zhang, F. Di Giacomo, M. Najafi, S. Veenstra, J. Szmytkowski and Y. Galagan, *Nano Energy*, 2020, **67**, 104186.

