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Addition/Correction

# Correction to "A Critical Review of Thermal Boundary Conductance across Wide and Ultrawide Bandgap Semiconductor Interfaces"

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In the original version of this article, the reference numbers in Tables 2, 3, and 4 are wrong. The correct tables are listed below.

Also the original Acknowledgment section has a mistake, in which the INL support should be removed since the writing of this review was finished before and without the INL support. The correct Acknowledgment should read as follows: T.F. and H.Z. acknowledge the support from the University of Utah and the ORAU Ralph E. Powe Junior Faculty Enhancement Award. Z.C. acknowledges the Fundamental Research Funds for the Central Universities, Peking University.

## Table 2. Thermal Boundary Conductance between GaN and Other Materials[a]

| | Growth Method | Interlayer | Measurement Method | TBC ($MW\,m^{-2}\,K^{-1}$) | Ref. |
|---|---|---|---|---|---|
| GaN/diamond | CVD | None | TTR | 4.5 | Waller 2020 [84] |
| GaN/diamond | CVD | None | CTR | 12–15 | Gu 2016 [52] |
| GaN/diamond | CVD | None | TDTR | 21.2 | Yates 2018 [85] |
| GaN/diamond | MBE | Unknown | Optical | <10 | Kuzmik 2011 [145] |
| GaN/diamond | High-T bonding | Adhesion layer | TDTR | 21–28 | Cho 2013 [108] |
| GaN/diamond | RT SAB | 2nm a-Si+2.2nm a-dia | TDTR | 92 | Cheng 2020 [104] |
| GaN/diamond | CVD | ~5 nm AlN | CTR | 55–100 | Gu 2016 [52] |
| GaN/diamond | CVD | ~5 nm $SiN_x$ | TDTR | ~100 | Yates 2018 [85] |
| GaN/diamond | CVD | ~5 nm $SiN_x$ | TTR | ~150 | Zhou 2017 [4,86] |
| GaN/diamond | CVD | ~5 nm SiN | CTR | 167–400* | Gu 2016 [52] |
| GaN/diamond | MOCVD | ~5 nm $SiN_x$ | TTR | 323* | Malakoutian 2021 [53] |
| GaN/diamond | CVD | ~5 nm AlN | TDTR | 55 | Yates 2018 [85] |
| GaN/diamond | SAB | 10nm a-Si+3nm a-dia | TDTR | 53 | Cheng 2020 [104] |
| GaN/diamond | SAB+800°C ann. | 15nm c-Si+3nm a-dia | TDTR | 70 | Mu 2021 [105] |
| GaN/diamond | SAB | 15nm a-Si+3nm a-dia | TDTR | 30 | Mu 2021 [105] |
| GaN/diamond | SAB | 22nm a-Si+3nm a-dia | TDTR | 25 | Mu 2021 [105] |
| GaN/diamond | SAB+800°C ann. | 24nm c-Si+3nm a-dia | TDTR | 85 | Mu 2021 [105] |
| GaN/diamond | High-T bonding | ~22 nm $SiN_x$ | TDTR | 51–57 | Cho 2017 [109] |
| GaN/diamond | CVD | ~25 nm $SiN_x$ | TDTR | ~35 | Cho 2014 [87] |
| GaN/diamond | CVD | ~25 nm dielectric | Raman | ~37 | Pomeroy 2013 [146], 2014 [89] |
| GaN/diamond | CVD | 28 nm $SiN_x$ | TTR | 83 | Sun 2015 [90] |
| GaN/diamond | High-T bonding | ~31 nm SiN | TDTR | 31 | Cho 2017 [109] |
| GaN/diamond | CVD | ~40 nm dielectric | Raman | 34.5 | Altman 2014 [91] |
| GaN/diamond | CVD | ~50 nm dielectric | Raman | 56 | Dumka 2013 [92] |
| GaN/diamond | PVD | Ti (5 nm)/AuSn (40 nm)/Ti (5 nm) | TDTR | 13.2 | Yang 2021 [83] |
| GaN/diamond | CVD | ~50 nm dielectric | Raman | ~28 | Pomeroy 2014 [89] |
| GaN/diamond | Simulations | None | NEMD Tersoff | ~13 | Tao 2017 [147] |
| GaN/diamond | Simulations | Monolayer graphene | NEMD Tersoff | ~15 | Tao 2017 [147] |
| GaN/diamond | Simulations | Trilayer graphene | NEMD Tersoff | ~4 | Tao 2017 [147] |
| GaN/diamond | Simulations | Interlaced teeth | NEMD Tersoff | ~19 | Tao 2017 [147] |
| GaN/diamond | Simulations | Interlaced teeth w/ monolayer graphene | NEMD Tersoff | ~29 | Tao 2017 [147] |
| GaN/diamond | Simulations | Interlaced teeth w/ trilayer graphene | NEMD Tersoff | ~14 | Tao 2017 [147] |
| GaN/diamond | AMM | N/A | Theory | ~333 | Cho 2017 [109] |
| GaN/SiC | MBE | None | FDTR | 230 | Ziade 2015 [80] |
| GaN/SiC | SAB | 3 nm a-SiC | TDTR | 170 | Mu 2019 [106] |
| GaN/SiC | SAB+1000°C ann. | 3 nm c-SiC (inhomo.) | TDTR | 230 | Mu 2019 [106] |
| GaN/SiC | CVD | 5nm SiN | TTR | 154 | Zhou 2017 [86] |
| GaN/SiC | MOCVD | 36 nm AlN | TDTR | 200 | Cho 2012 [78,148] |
| GaN/SiC | MBE | 38 nm AlN | TDTR | 185 | Cho 2014 [87] |
| GaN/SiC | Epitaxial growth | 50 nm AlN | TTR | 40 | Liu 2019 [113] |
| GaN/SiC | PVD | Ti (5 nm)/AuSn (40 nm)/Ti (5 nm) | TDTR | 14.8 | Yang 2021 [83] |
| GaN/SiC | MOCVD | Unknown | TIM | 8.3 | Kuzmík 2007 [149] |
| GaN/SiC | Simulations | None | NEMD Tersoff | ~520 | Hu 2011 [150] |
| GaN/SiC | Simulations | None | NEMD Tersoff | 420 | Hu 2013 [151] |
| GaN/SiC | Simulations | None | NEMD Tersoff | 470 | Lee 2016 [152] |
| GaN/SiC | Simulations | None | NEMD Tersoff | 794 | Lee 2017 [153] |
| GaN/SiC | Simulations | None | NEMD Tersoff | 495 | Li 2019 [154] |
| GaN/SiC | Simulations | None | NEMD Tersoff | 470 | Lee 2018 [155] |
| GaN/SiC | Simulations | 4 nm $Ga^{15}N$ (isotope) | NEMD Tersoff | 555 | Lee 2018 [155] |
| GaN/SiC | Simulations | 1×8 nm interlaced teeth | NEMD Tersoff | ~800 | Hu 2011 [150] |
| GaN/SiC | Simulations | 1 nm AlN | NEMD Tersoff | 570–630 | Hu 2011 [150] |
| GaN/SiC | Simulations | Graphene | NEMD Tersoff | 601 | Hu 2013 [151] |
| GaN/SiC | Simulations | 1×5-8 nm teeth | NEMD Tersoff | 670 | Lee 2016 [152] |
| GaN/SiC | Simulations | 2.6 nm AB ($m_A$=51.7, $m_B$=10.3) | NEMD Tersoff | 971 | Lee 2017 [153] |
| GaN/SiC | Simulations | 2.5 nm 10% boron dop. | NEMD Tersoff | 716 | Li 2019 [154] |
| GaN/SiC | Simulations | 2.5 nm 50% boron allo. | NEMD Tersoff | 755 | Li 2019 [154] |
| GaN/SiC | Simulations | 2.5 nm 10% boron allo. | NEMD Tersoff | 577 | Li 2019 [154] |
| GaN/Si | MBE | 38 nm AlN | TDTR | 188* | Cho 2012 [78] |
| GaN/Si | MBE | 38 nm AlN | TDTR | 128 | Cho 2014 [79] |
| GaN/Si | MOCVD | 100 nm AlN | TDTR | 263 | Yates 2015 [99] |
| GaN/Si | PVD | Ti (5 nm)/AuSn (40 nm)/Ti (5 nm) | TDTR | 16.5 | Yang 2021 [83] |
| GaN/AlN | MBE | None | TDTR | 620 | Koh 2009 [156] |
| GaN/AlN | Simulations | None | EMD/NEMD (SW) extplt. to ∞ | ~1150–1300 | Liang 2014 [157,158] |
| GaN/AlN | Simulations | None | NEMD (Tersoff) | 475 | Lee 2018 [155] |
| GaN/AlN | Simulations | None | Green's function | 300 | Polanco 2019 [159] |
| GaN/AlN | Simulations | None | NEMD SW ex. ∞ | 825 | Wang 2021 [160] |
| GaN/AlN | Simulations | None | NEMD LJ | 780 | Bao 2022 [161] |
| GaN/AlN | Simulations | None | Monte Carlo | 870 | Bao 2022 [161] |
| GaN/AlN | Simulations | None | NEMD SW | 937 | Sun 2021 [162] |
| GaN/AlN | Simulations | None | NEMD (Tersoff – mixing rule) | 3124 | Sun 2021 [162] |
| GaN/AlN | Simulations | None | NEMD (Transf. Tersoff) | 3225 | Sun 2021 [162] |
| GaN/AlN | Simulations | 2 nm amorphous layer | NEMD SW | 149 | Wang 2021 [160] |
| GaN/AlN | Simulations | 2 nm ann. cryst. layer | NEMD SW | 197 | Wang 2021 [160] |
| GaN/AlN | Simulations | Dislocation (lat. mis.) | NEMD SW | 496 | Sun 2021 [162] |
| GaN/AlN | Simulations | Dislocation (lat. mis.) | NEMD (Tersoff – mixing rule) | 2440 | Sun 2021 [162] |
| GaN/AlN | Simulations | Dislocation (lat. mis.) | NEMD (Transf. Tersoff) | 1933 | Sun 2021 [162] |
| GaN/BAs | Oxygen plasma | 2-nm amorphous $Al_2O_3$ | TDTR | 250 | Kang 2021 [101] |
| GaN/$Al_2O_3$ | MOCVD | Unclear | TDTR | 10 | Wang 2014 [163] |
| GaN/$Al_2O_3$ | MOCVD | Unclear | TIM | 8.3 | Kuzmík 2007 [149] |
| GaN/$Al_2O_3$ | MOCVD | Unclear | 3ω method | 10 | Wang 2015 [164] |
| GaN/$SiO_2$ | Plasma-enh. CVD | Unclear | 3ω method | 15 | Wang 2015 [164] |
| GaN/ZnO | PVD | 10–12 nm defective | TDTR | 490 | Gaskins 2018 [165] |
| GaN/ZnO | Model | None | DMM | 240 | Gaskins 2018 [165] |
| GaN/ZnO | Simulations | None | AGF DFT | 295 | Gaskins 2018 [165] |
| GaN/Al | PVD | Unclear | TTR | 190 | Stevens 2005 [114] |
| GaN/Al | PVD | Unclear | TDTR | 92 | Donovan 2014 [12] |
| GaN/Al | PVD | Unclear | TDTR | 160 | Wang 2014 [163] |
| GaN/Al | PVD | Unclear | TDTR | 47–161 | Cho 2014 [79] |
| GaN/Al | PVD | Unclear | TDTR | 400 | Koh 2021 [81] |
| GaN/Au | PVD | Unclear | TDTR | 55 | Donovan 2014 [12] |
| GaN/Au | PVD | Ti adhesion layer | TDTR | ~250 | Donovan 2014 [12] |
| GaN/Cr | PVD | Unclear | TTR | 230 | Stevens 2005 [114] |
| GaN/Au or Cr | PVD | Unclear | FDTR | 180 | Freedman 2013 [166] |
| GaN/Al | Simulations | None | NEMD LJ | 211 | Jones 2013 [167] |
| GaN/Al | Simulations | Al-Ga contact | NEMD SW | 99 | Zhou 2013 [168] |
| GaN/Al | Simulations | 3×7 nm Al-Ga teeth | NEMD SW | 102 | Zhou 2013 [168] |
| GaN/Al | Simulations | 3×7 nm Al-N teeth | NEMD SW | 172 | Zhou 2013 [168] |
| GaN/Al | NE Landauer | None | DFT | 427 | Koh 2021 [81] |

[a]Greened and greyed boxes are for experimental and simulation data, respectively. *These values may have a large uncertainty.

## Table 3. Thermal Boundary Conductance of Si/Diamond and Si/SiC Interfaces

| | Growth/ Simulation Method | Interlayer | Measurement Method/Interatomic Potential | TBC ($MW\,m^{-2}\,K^{-1}$) | Ref. |
|---|---|---|---|---|---|
| Si/diamond | Graphoepitaxy | None | TDTR | 64 | Cheng 2019 [76] |
| Si/diamond | CVD | None | TPS | 50-100 | Goyal 2010 [94] |
| Si/diamond | Unclear | Unclear | Unclear | 30 | Goodson 1994 [172] |
| Si/diamond | CVD | ~10 nm amorph. | Joule-heating | >67 | Goodson 1995 [96] |
| Si/diamond | CVD | Unclear | Laser pulse | 18 | Klokov 2010 [97] |
| Si/diamond | CVD | Unclear | 3ω method | 50 | Mohr 2017 [98] |
| Si/diamond | Graphoepitaxy | 47×69 nm teeth | TDTR | 105 | Cheng 2019 [76] |
| Si/diamond | Graphoepitaxy | 105×210 nm teeth | TDTR | 80 | Cheng 2019 [76] |
| Si/diamond | Simulations | None | NEMD Tersoff (45nm) | 381 | Cheng 2019 [76] |
| Si/diamond | Simulations | 2 nm a-C | NEMD Tersoff (45nm) | 378 | Cheng 2019 [76] |
| Si/diamond | Simulations | None | NEMD Brenner (6nm) | 238 | Khosravian 2013 [173] |
| Si/diamond | Simulations | None | NEMD Brenner (13nm) | 482 | Khosravian 2013 [173] |
| Si/SiC | Low-temp. CVD | None | TDTR | 600 | Cheng 2022 [174] |
| Si/SiC | Hydrophobic bonding | 0.2–2.5nm a-$SiO_2$ | TTR | 100–250 | Field 2022 [102] |
| Si/SiC | Hydrophilic bonding | 2.5 nm a-$SiO_2$ | TTR | 80–110 | Field 2022 [102] |
| Si/SiC | NEMD | None | Tersoff | 890 | Xu 2022 [77] |
| Si/SiC | NEMD | Interlaced teeth | Tersoff | 300–1000 | Xu 2022 [77] |

## Table 4. Thermal Boundary Conductance between $\beta$-$Ga_2O_3$ and Other Materials

| β-$Ga_2O_3$/substrate | Growth/Simulation Method | Interlayer | Method | TBC ($MW\,m^{-2}\,K^{-1}$) | Ref. |
|---|---|---|---|---|---|
| $Ga_2O_3$/diamond | Transferred | None (van der Waals) | TDTR | 17 | Cheng 2019 [66] |
| $Ga_2O_3$/diamond | ALD | None (ultra-clean) | TDTR | 179 | Cheng 2019 [66] |
| $Ga_2O_3$/diamond | ALD | Ga-rich | TDTR | 136 | Cheng 2019 [66] |
| $Ga_2O_3$/diamond | ALD | O-rich | TDTR | 139 | Cheng 2019 [66] |
| $Ga_2O_3$/diamond | Hydrophilic bonding + 250 °C annealing | None (ultra-clean) | - | - | Matsumae 2020 [103] |
| $Ga_2O_3$/SiC | SAB + 800 °C ann. | Unclear | TDTR | 150 | Cheng 2021 [175] |
| $Ga_2O_3$/SiC | SAB | 30nm $Al_2O_3$ + 3.5nm a-SiC | TDTR | 72 | Cheng 2020 [61] |
| $Ga_2O_3$/SiC | SAB + 800 °C ann. | 30nm $Al_2O_3$ + 2nm a-SiC | TDTR | 65 | Cheng 2020 [61] |
| $Ga_2O_3$/SiC | SAB | 9.4nm $Al_2O_3$ + 2.7nm a-SiC | TDTR | 100 | Cheng 2020 [61] |
| $Ga_2O_3$/SiC | SAB + 800 °C ann. | 9nm $Al_2O_3$ + 2nm a-SiC | TDTR | 88 | Cheng 2020 [61] |
| $Ga_2O_3$/SiC | SAB | 1.8nm a-$Ga_2O_3$ + 2.2nm a-SiC | - | - | Xu 2019 [107] |
| $Ga_2O_3$/SiC | SAB + 1000 °C ann. | 1.5nm crystal defective layer | TDTR | 244 | Liang 2022 [176] |
| $Ga_2O_3$/SiC | SAB + 200 °C ann. | 1.3nm a-$Ga_2O_3$ + 2.2nm a-SiC | - | - | Xu 2019 [107] |
| $Ga_2O_3$/diamond | Theory | None | DMM | 312 | Cheng 2019 [66] |
| $Ga_2O_3$/Au | Wedge deposition | None | FDTR | 45 | Aller 2019 [177] |
| $Ga_2O_3$/Au | E-beam evaporation | Defective layer | TDTR | 31.2 | Shi 2021 [63] |
| $Ga_2O_3$/Ti | E-beam evaporation | Defective layer | TDTR | 17.4 | Shi 2021 [63] |
| $Ga_2O_3$/Ni | E-beam evaporation | Defective layer | TDTR | 82.7 | Shi 2021 [63] |
| $Ga_2O_3$/Al | E-beam evaporation | Defective layer | TDTR | 81.7 | Shi 2021 [63] |
| $Ga_2O_3$/Au | Wedge deposition | 2.5 nm Cr | FDTR | 530 | Aller 2019 [177] |
| $Ga_2O_3$/Au | Wedge deposition | 5 nm Ti | FDTR | 260 | Aller 2019 [177] |
| $Ga_2O_3$/Au | Wedge deposition | >3 nm Ni | FDTR | 410 | Aller 2019 [177] |
| $Ga_2O_3$/Au | Theory | None | DMM | 71.2 | Shi 2021 [63] |
| $Ga_2O_3$/Ti | Theory | None | DMM | 103 | Shi 2021 [63] |
| $Ga_2O_3$/Ni | Theory | None | DMM | 126 | Shi 2021 [63] |
| $Ga_2O_3$/Al | Theory | None | DMM | 139.6 | Shi 2021 [63] |
| $Ga_2O_3$/Cr | Theory | None | DMM | 148.7 | Shi 2021 [63] |


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