Supplementary Materials

The Stability of Quantum-dot Light Emitting Diodes with Alkali Metal Carbonates Blending in Mg doped ZnO Electron Transport Layer

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Figure S1. Absorbance and normalized PL characteristics of R-QDs used in this study.

Table S1. Chemical structure, molecular weight, melting point and boiling point characteristics of alkali metal carbonates used in this study.

| Alkali Metal Carbonate | Cs₂CO₃ | Rb₂CO₃ | K₂CO₃ | Na₂CO₃ | Li₂CO₃ |
|------------------------|-------|-------|-------|-------|-------|
| Chemical structure     | ![Chemical Structure Cs₂CO₃](image1) | ![Chemical Structure Rb₂CO₃](image2) | ![Chemical Structure K₂CO₃](image3) | ![Chemical Structure Na₂CO₃](image4) | ![Chemical Structure Li₂CO₃](image5) |
| Mₘ (g/mol)³ | 325.82 | 230.945 | 138.2 | 105.99 | 73.89 |
| m.p (°C)² | 610 | 837 | 891 | 851 | 723 |
| b.p (°C)³ | N/A | 900 | N/A | N/A | 1310 |

¹Mₘ: Molecular weight
²m.p: Melting point
³b.p: Boiling point
Figure S2. Electrical stability characteristics of EODs with alkali metal carbonate blended MZO ETL and QD EML. Current-voltage characteristic of EODs with (a) MZO, (b) Cs$_2$CO$_3$:MZO, (c) Rb$_2$CO$_3$:MZO, (d) K$_2$CO$_3$:MZO, (e) Na$_2$CO$_3$:MZO and (f) Li$_2$CO$_3$:MZO ETL. Inset figures exhibit temperature images of each EODs captured by IR camera during the constant current stress. Here, the constant current stress condition at each EODs was fixed as 50 mA for 30 min in 4 mm$^2$ active area.
Figure S3. Summarized electrical stability (hysteresis) characteristics of EODs with alkali metal carbonate blended MZO ETLs at 0.1 V before and after current stress (50 mA for 30 min).

Table S2. Summarized lifetime and current efficiency characteristics of inverted R-QLEDs reported in literatures.

| Year | Structure | CE\(^{\text{b}}\) (cd/A) | EL\(_{\text{peak}}\) (nm) | L\(_{\text{int}}\) (cd/m\(^2\)) | Lifetime (@ T\(_{95}\), hr) | Ref. |
|------|-----------|-----------------|-----------------|-----------------|-----------------|-----|
| 2013 | ITO/AZO:Cs\(_2\)CO\(_3\)/QDs/TCTA/NPB/HAT-CN/Al | ~4.5 | 630 | N/A | N/A | [1] |
| 2015 | ITO/ZnO NPs/Cs\(_2\)CO\(_3\)/QDs/NPB/LG101/Al | ~19 | ~620 | 2000 | ~20 | [2] |
| 2018 | ITO/ZnO:Cs\(_2\)CO\(_3\)/QDs/p-TPD/PEDOT:PSS/Triton X-100/Al | ~5 | 622 | N/A | N/A | [3] |
| 2018 | ITO/ZnO:Cs\(_2\)CO\(_3\)/QDs/p-TPD/PEDOT:PSS/Triton X-100/Al | N/A | 630 | N/A | N/A | [4] |
| 2019 | ITO/LZO/MZO:Rb\(_2\)CO\(_3\)/QDs/TCTA/NPB/HAT-CN/Al | ~13 | 623 | 1,000 | ~200 | [5] |

This study

| ITO/LZO/MZO:Cs\(_2\)CO\(_3\)/QDs/TCTA/NPB/HAT-CN/Al | 10.1 | 623 | 1,000 | ~407 | - |
| ITO/LZO/MZO:Rb\(_2\)CO\(_3\)/QDs/TCTA/NPB/HAT-CN/Al | 11.7 | 623 | 1,000 | ~620 | - |

\(^{b}\) CE values were measured at high luminance of 50,000 cd/m\(^2\).
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