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# The Structure and Optical Properties of Luminescent Europium Terephthalate Antenna Metal–Organic Frameworks Doped by Yttrium, Gadolinium, and Lanthanum Ions

**Oleg S. Butorlin, Anna S. Petrova, Yulia N. Toikka, Ilya E. Kolesnikov, Sergey N. Orlov, Mikhail N. Ryazantsev, Nikita A. Bogachev, Mikhail Yu. Skripkin and Andrey S. Mereshchenko**

## Supplementary Materials

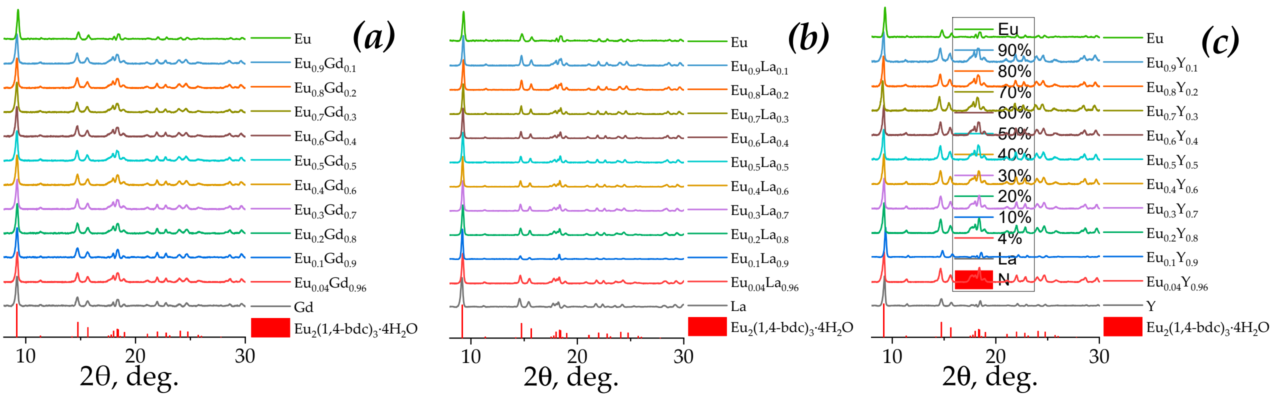


**Figure S1.** The powder X-ray diffraction (PXRD) patterns of the synthesized compounds series: ***(a)*** $(Eu_xGd_{1-x})_2(1,4\text{-bdc})_3{\cdot}nH_2O$ (x = 0.001-1) including the $Gd_2(1,4\text{-bdc})_3{\cdot}nH_2O$, ***(b)*** $(Eu_xLa_{1-x})_2(1,4\text{-bdc})_3{\cdot}nH_2O$ (x = 0.001-1) including the $La_2(1,4\text{-bdc})_3{\cdot}nH_2O$, ***(c)*** $(Eu_xY_{1-x})_2(1,4\text{-bdc})_3{\cdot}nH_2O$ (x = 0.001-1) including the $Y_2(1,4\text{-bdc})_3{\cdot}nH_2O$. The positions and relative intensities of diffraction maxima of $Eu_2(1,4\text{-bdc})_3{\cdot}4H_2O$ taken from ref. [20] are shown as bars.

**Table S1.** Unit cell parameters of the $(Eu_xM_{1-x})_2(1,4\text{-bdc})_3{\cdot}4H_2O$ (M = Y, La, Gd; x = 0.04-1). The parameters obtained within the same series of connections are separated from each other inside the table by a bold line

| **$(Eu_xLa_{1-x})_2(1,4\text{-bdc})_3{\cdot}4H_2O$** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **x** | **V, Å³** | **a, Å** | **b, Å** | **c, Å** | **α, °** | **β, °** | **γ, °** |
| **0.04** | 632.6±0.3 | 6.2732±0.0017 | 10.251±0.002 | 10.327±0.003 | 102.488±0.008 | 91.988±0.01 | 101.767±0.009 |
| **0.1** | 633.6±0.4 | 6.272±0.003 | 10.269±0.003 | 10.323±0.004 | 102.433±0.009 | 92.023±0.012 | 101.722±0.01 |
| **0.2** | 632.0±0.3 | 6.2653±0.0017 | 10.261±0.002 | 10.314±0.003 | 102.416±0.008 | 91.988±0.011 | 101.701±0.009 |
| **0.3** | 629.8±0.2 | 6.2617±0.0014 | 10.2404±0.0019 | 10.305±0.002 | 102.439±0.007 | 91.829±0.01 | 101.724±0.008 |
| **0.4** | 627.38±0.19 | 6.2549±0.0012 | 10.2213±0.0015 | 10.2910±0.0018 | 102.410±0.006 | 91.725±0.009 | 101.684±0.007 |
| **0.5** | 622.74±0.15 | 6.2375±0.0009 | 10.1916±0.0013 | 10.2697±0.0014 | 102.382±0.006 | 91.690±0.008 | 101.637±0.006 |
| **0.6** | 620.84±0.15 | 6.2312±0.0009 | 10.1781±0.0013 | 10.2598±0.0014 | 102.370±0.005 | 91.617±.008 | 101.615±0.006 |
| **0.7** | 618.49±0.13 | 6.2230±0.0008 | 10.1656±0.0011 | 10.2443±0.0013 | 102.334±0.005 | 91.574±0.007 | 101.598±0.006 |
| **0.8** | 615.56±0.13 | 6.2132±0.0008 | 10.1468±0.0012 | 10.2272±0.0013 | 102.315±0.005 | 91.518±0.0007 | 101.546±0.006 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **0.9** | 613.0±0.2 | 6.2053±0.0013 | 10.1384±0.0018 | 10.2058±0.0019 | 102.306±0.007 | 91.476±0.010 | 101.563±0.008 |
| **1** | 610.0±0.2 | 6.1964±0.0015 | 10.120±0.002 | 10.183±0.002 | 102.233±0.007 | 91.484±0.011 | 101.507±0.009 |
| **$(Eu_xGd_{1-x})_2(1,4\text{-bdc})_3\cdot4H_2O$** | | | | | | | |
| **x** | **V, Å³** | **a, Å** | **b, Å** | **c, Å** | **α, °** | **β, °** | **γ, °** |
| **0.04** | 603.3±0.4 | 6.173±0.003 | 10.086±0.004 | 10.139±0.004 | 102.197±0.011 | 91.423±0.019 | 101.441±0.015 |
| **0.1** | 606.2±0.4 | 6.184±0.003 | 10.103±0.004 | 10.152±0.004 | 102.159±0.010 | 91.515±0.017 | 101.419±0.013 |
| **0.2** | 604.2±0.4 | 6.175±0.003 | 10.094±0.003 | 10.141±0.004 | 102.185±0.010 | 91.465±0.017 | 101.404±0.013 |
| **0.3** | 605.3±0.6 | 6.180±0.004 | 10.097±0.005 | 10.150±0.006 | 102.195±0.013 | 91.41±0.02 | 101.416±0.018 |
| **0.4** | 604.2±0.5 | 6.177±0.003 | 10.090±0.004 | 10.142±0.005 | 102.196±0.011 | 91.431±0.019 | 101.438±0.015 |
| **0.5** | 605.0±0.6 | 6.179±0.004 | 10.098±0.005 | 10.147±0.005 | 102.202±0.012 | 91.45±0.02 | 101.460±0.016 |
| **0.6** | 604.0±0.5 | 6.178±0.003 | 10.090±0.004 | 10.142±0.004 | 102.205±0.012 | 91.472±0.019 | 101.469±0.015 |
| **0.7** | 604.7±0.5 | 6.178±0.003 | 10.096±0.005 | 10.147±0.005 | 102.223±0.012 | 91.45±0.02 | 101.471±0.015 |
| **0.8** | 604.6±0.5 | 6.180±0.003 | 10.091±0.005 | 10.091±0.005 | 102.208±0.013 | 91.50±0.02 | 101.481±0.017 |
| **0.9** | 605.5±0.6 | 6.183±0.004 | 10.100±0.005 | 10.150±0.005 | 102.215±0.013 | 91.50±0.02 | 101.485±0.016 |
| **1** | 604.1±0.6 | 6.184±0.004 | 10.089±0.005 | 10.126±0.006 | 102.114±0.012 | 91.53±0.02 | 101.385±0.015 |
| **$(Eu_xY_{1-x})_2(1,4\text{-bdc})_3\cdot4H_2O$** | | | | | | | |
| **x** | **V, Å³** | **a, Å** | **b, Å** | **c, Å** | **α, °** | **β, °** | **γ, °** |
| **0.04** | 600.1±0.2 | 6.1767±0.0011 | 10.060±0.003 | 10.0942±0.0016 | 102.016±0.010 | 91.555±0.014 | 101.316±0.012 |
| **0.1** | 597.2±0.3 | 6.1659±0.0016 | 10.043±0.002 | 10.082±0.003 | 102.015±0.007 | 91.555±0.010 | 101.340±0.009 |
| **0.2** | 596.0±0.2 | 6.1611±0.0015 | 10.035±0.002 | 10.078±0.002 | 102.041±0.007 | 91.521±0.010 | 101.349±0.009 |
| **0.3** | 598.6±0.4 | 6.169±0.002 | 10.054±0.003 | 10.092±0.004 | 102.056±0.009 | 91.520±0.015 | 101.371±0.013 |
| **0.4** | 598.4±0.4 | 6.166±0.002 | 10.052±0.003 | 10.096±0.003 | 102.066±0.009 | 91.522±0.014 | 101.389±0.012 |
| **0.5** | 600.0±0.3 | 6.171±0.002 | 10.059±0.003 | 10.110±0.003 | 102.099±0.010 | 91.512±0.015 | 101.405±0.013 |
| **0.6** | 601.2±0.4 | 6.175±0.003 | 10.067±0.003 | 10.118±0.004 | 102.117±0.010 | 91.479±0.017 | 101.438±0.014 |
| **0.7** | 602.4±0.4 | 6.177±0.003 | 10.075±0.003 | 10.127±0.004 | 102.125±0.010 | 91.508±0.017 | 91.508±0.017 |
| **0.8** | 603.2±0.4 | 6.179±0.002 | 10.079±0.003 | 10.133±0.004 | 102.155±0.010 | 91.482±0.016 | 101.444±0.014 |
| **0.9** | 604.8±0.4 | 6.184±0.002 | 10.091±0.003 | 10.142±0.004 | 102.161±0.010 | 91.492±0.016 | 91.492±0.016 |
| **1** | 604.1±0.6 | 6.184±0.004 | 10.089±0.005 | 10.126±0.006 | 102.114±0.012 | 91.53±0.02 | 101.385±0.015 |

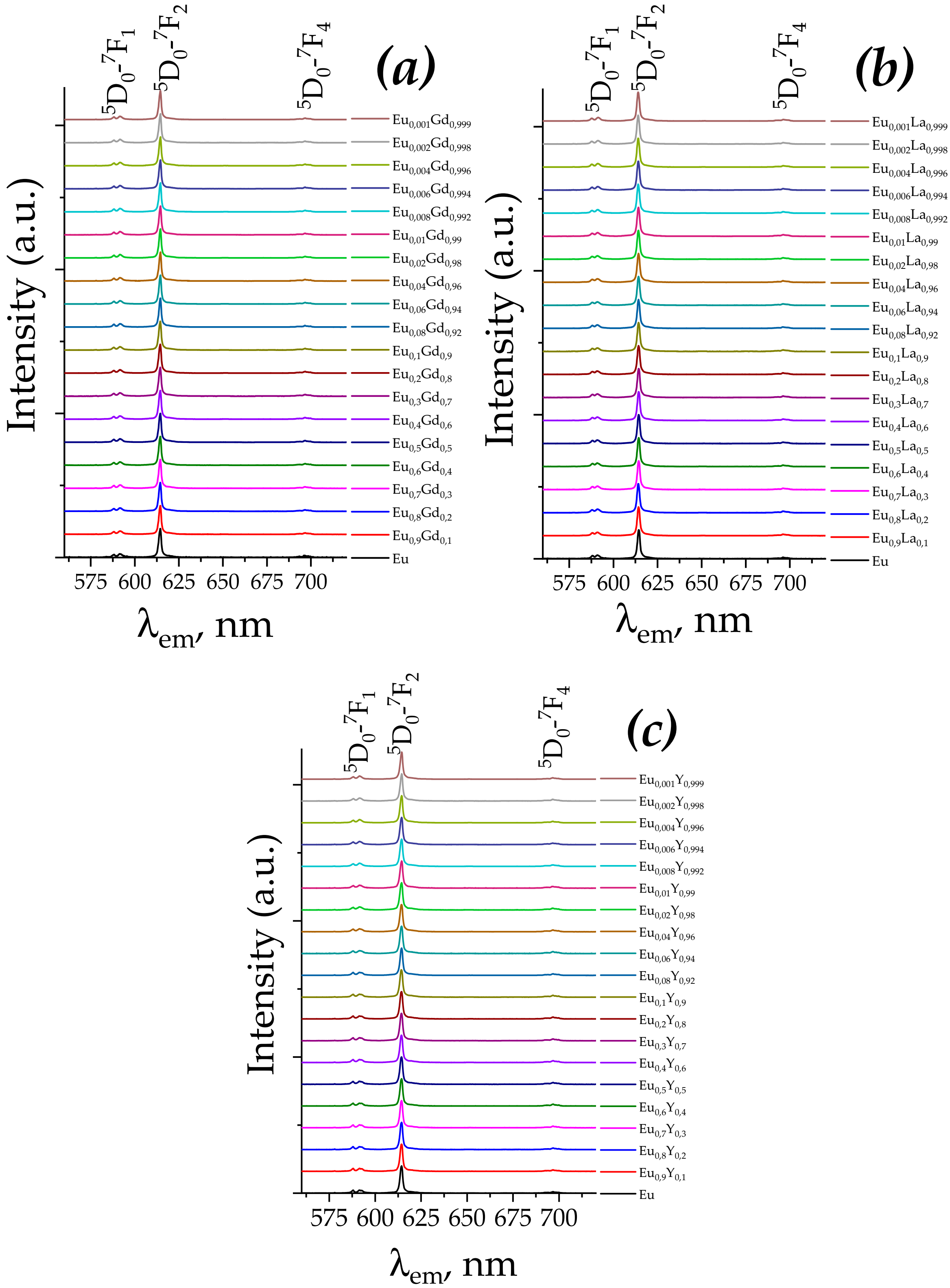


**Figure S2.** The normalized emission spectra of ***(a)*** $(Eu_xGd_{1-x})_2(1,4\text{-bdc})_3\cdot4H_2O$, ***(b)*** $(Eu_xLa_{1-x})_2(1,4\text{-bdc})_3\cdot4H_2O$, ***(c)*** $(Eu_xY_{1-x})_2(1,4\text{-bdc})_3\cdot4H_2O$ at a wide concentration range of $Eu^{3+}$ (x = 0.001-1; given in legend) upon 300 nm excitation.

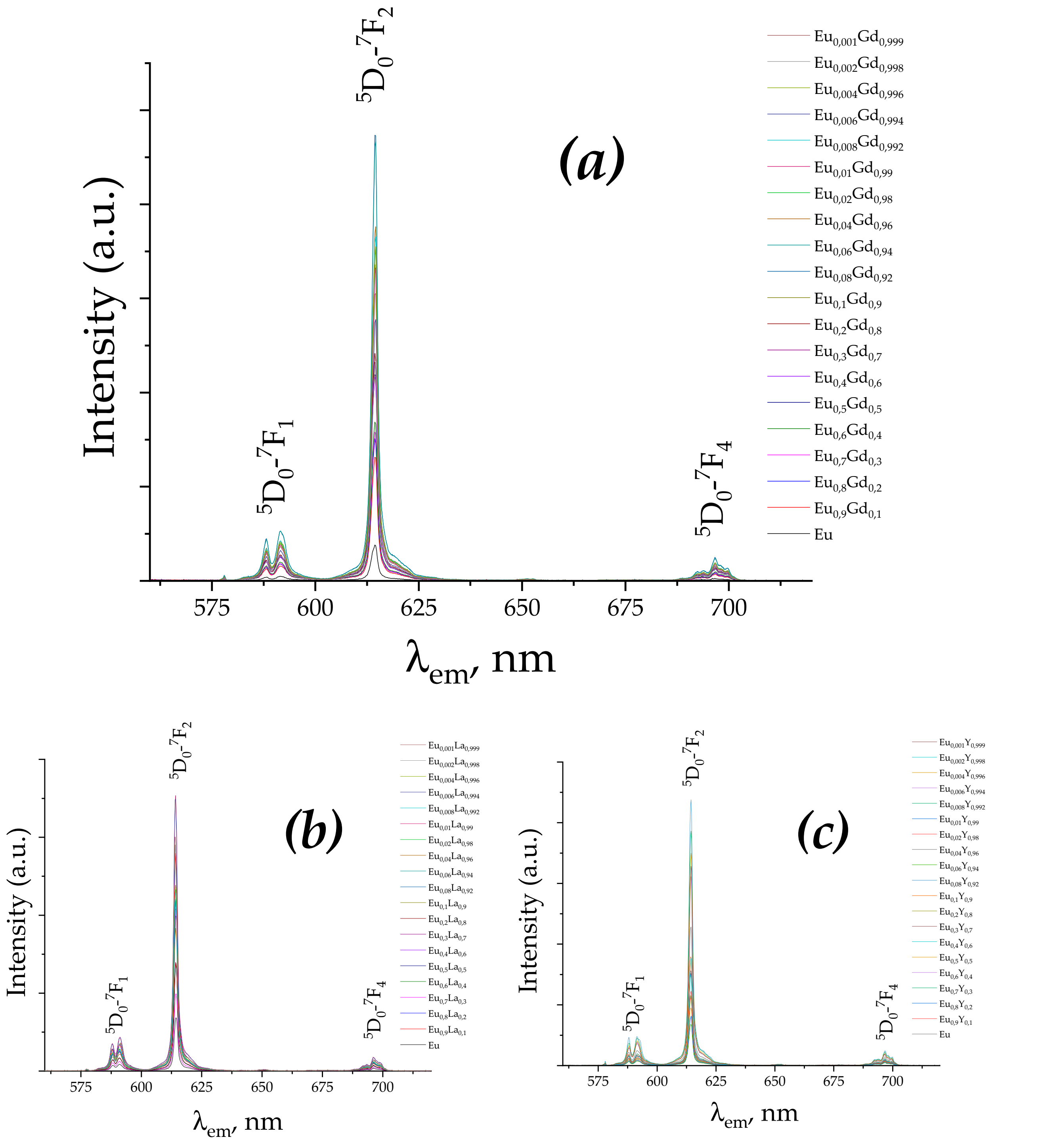


**Figure S3.** The superimposed emission spectra of ***(a)*** $(Eu_xGd_{1-x})_2(1.4\text{-bdc})_3\cdot 4H_2O$, ***(b)*** $(Eu_xLa_{1-x})_2(1.4\text{-bdc})_3\cdot 4H_2O$, ***(c)*** $(Eu_xY_{1-x})_2(1.4\text{-bdc})_3\cdot 4H_2O$ at a wide concentration range of $Eu^{3+}$ (x = 0.001-1; give in legend) upon 300-nm excitation.

**Table S2.** $Eu^{3+}$ atomic fractions (at.%) in the synthesized compounds namely $(Eu_xM_{1-x})_2(1,4\text{-bdc})_3\cdot 4H_2O$. Measured data obtained from EDX.

| $X_{Eu}$ (at.%), theoretical | $X_{Eu}$ (at.%) in Eu-Gd series | $X_{Eu}$ (at.%) in Eu-La series | $X_{Eu}$ (at.%) in Eu-Y series |
|---|---|---|---|
| 0,1 | | Low then the LOD* | |
| 0,2 | | Low then the LOD | |
| 0,4 | | Low then the LOD | |
| 0,6 | | Low then the LOD | |
| 0,8 | | Low then the LOD | |
| 1 | 2 ± 1 | 3 ± 1 | 1 ± 1 |
| 2 | 2 ± 1 | 3 ± 1 | 3 ± 1 |
| 4 | 4 ± 1 | 5 ± 1 | 5 ± 1 |
| 6 | 7 ± 1 | 7 ± 1 | 7 ± 1 |
| 8 | 8 ± 1 | 9 ±1 | 8± 1 |
| 10 | 9± 1 | 11 ± 1 | 12± 1 |
| 20 | 18 ± 1 | 24 ± 1 | 20 ± 1 |
| 30 | 31 ± 2 | 35 ± 2 | 31± 2 |
| 40 | 40± 2 | 44 ± 2 | 44± 2 |
| 50 | 51 ± 3 | 55 ± 3 | 53 ± 3 |
| 60 | 58± 4 | 63± 4 | 65 ± 4 |
| 70 | 68± 4 | 67±4 | 70± 4 |
| 80 | 85± 5 | 83 ± 5 | 83± 5 |
| 90 | 93 ± 5 | 91± 5 | 91± 5 |
| 100 | 100 | 100 | 100 |

*LOD – limit of detection.