

Supporting information

Inductively coupled plasma optical emission spectroscopic determination of trace rare earth elements in highly refractory gadolinium zirconate ($Gd_2Zr_2O_7$)

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Table T1:

Synthetic standard set of G1 was prepared by considering dissolution of 50 mg of $Gd_2Zr_2O_7$ sample in 100 mL solution.

Synthetic standard set of G2 was prepared by considering dissolution of 100 mg of $Gd_2Zr_2O_7$ sample in 100 mL solution.

Synthetic standard set of G3 was prepared by considering dissolution of 200 mg of $Gd_2Zr_2O_7$ sample in 100 mL solution.

Element	Synthetic standard set G1 (mg L ⁻¹)			Synthetic standard set G2 (mg L ⁻¹)			Synthetic standard set G3 (mg L ⁻¹)		
	G1A	G1B	G1C	G2A	G2B	G2C	G3A	G3B	G3C
Gd _{matrix}	258	258	258	516	516	516	1032	1032	1032
Zr _{matrix}	150	150	150	300	300	300	600	600	600
La	0.25	1.0	2.5	1.0	2.5	0.25	2.5	0.25	1.0
Ce	1.0	2.5	0.25	2.5	0.25	1.0	0.25	1.0	2.5
Pr	2.5	0.25	1.0	0.25	1.0	2.5	1.0	2.5	0.25
Nd	1.0	2.5	0.25	2.5	0.25	1.0	0.25	1.0	2.5
Sm	2.5	0.25	1.0	0.25	1.0	2.5	1.0	2.5	0.25
Eu	0.25	1.0	2.5	1.0	2.5	0.25	2.5	0.25	1.0
Tb	2.5	0.25	1.0	0.25	1.0	2.5	1.0	2.5	0.25
Dy	0.25	1.0	2.5	1.0	2.5	0.25	2.5	0.25	1.0
Ho	1.0	2.5	0.25	2.5	0.25	1.0	0.25	1.0	2.5
Er	0.25	1.0	2.5	1.0	2.5	0.25	2.5	0.25	1.0
Tm	1.0	2.5	0.25	2.5	0.25	1.0	0.25	1.0	2.5
Yb	2.5	0.25	1.0	0.25	1.0	2.5	1.0	2.5	0.25
Lu	0.25	1.0	2.5	1.0	2.5	0.25	2.5	0.25	1.0

Table T2:

Element	Emission line (nm)	Interference from Gd emission line (nm)	Interference from Zr emission line (nm)
La	412.323	Not present	412.338
Ce	418.66	Not present	418.669
Pr	417.939	Not present	417.981
Nd	401.225	Not present	401.225
Sm	388.529	Not present	388.542
Eu	381.967	Not present	381.984
Tb	332.44	Not present	Not present
Dy	353.17	Not present	Not present
Ho	345.6	Not present	345.591
Er	337.271	Not present	Not present
Tm	313.125	313.081	313.111
Yb	328.937	328.915	Not present
Lu	261.542	Not present	261.559

Table T3:

Elements	G1 (mg L ⁻¹)			G2 (mg L ⁻¹)			G3 (mg L ⁻¹)		
	G1A	G1B	G1C	G2A	G2B	G2C	G3A	G3B	G3C
La	0.245±0.005 (98)	0.98±0.01 (98)	2.40±0.04 (96)	1.00±0.02 (100)	2.44±0.03 (98)	0.248±0.004 (99)	2.38±0.05 (95)	0.235±0.006 (94)	0.93±0.02 (93)
Ce	0.99±0.01 (99)	2.42±0.05 (97)	0.252±0.005 (101)	2.45±0.04 (98)	0.251±0.005 (100)	0.96±0.02 (96)	0.213±0.003 (85)	0.92±0.02 (88)	2.20±0.06 (88)
Pr	2.45±0.04 (98)	0.242±0.004 (97)	0.95±0.02 (95)	0.245±0.04 (98)	0.98±0.02 (98)	2.40±0.05 (96)	0.86±0.04 (86)	2.23±0.06 (89)	0.211±0.006 (84)
Nd	0.96±0.02 (96)	2.39±0.04 (96)	0.244±0.004 (98)	2.40±0.04 (96)	0.248±0.003 (99)	0.97±0.02 (97)	0.213±0.006 (85)	0.87±0.03 (87)	2.23±0.07 (89)
Sm	2.44±0.04 (98)	0.238±0.003 (95)	0.96±0.01 (96)	0.239±0.004 (96)	0.97±0.02 (97)	2.46±0.05 (98)	0.87±0.03 (87)	2.20±0.05 (88)	0.212±0.006 (85)
Eu	0.250±0.004 (100)	0.97±0.02 (97)	2.52±0.05 (101)	0.96±0.02 (96)	2.49±0.05 (100)	0.245±0.004 (98)	2.30±0.06 (92)	0.225±0.006 (90)	0.90±0.03 (90)
Tb	2.41±0.04 (96)	0.245±0.005 (98)	0.95±0.01 (95)	0.243±0.002 (97)	0.98±0.01 (100)	2.44±0.04 (98)	0.84±0.02 (84)	2.04±0.06 (82)	0.210±0.006 (84)
Dy	0.248±0.003 (99)	1.02±0.02 (102)	2.46±0.04 (98)	0.95±0.01 (95)	2.40±0.04 (96)	0.242±0.003 (97)	2.30±0.05 (92)	0.220±0.005 (88)	0.90±0.03 (90)
Ho	0.99±0.01 (99)	2.48±0.03 (99)	0.254±0.003 (102)	2.40±0.03 (96)	0.239±0.004 (96)	0.98±0.01 (98)	0.202±0.007 (81)	0.85±0.04 (85)	2.16±0.06 (86)
Er	0.248±0.004 (99)	0.97±0.02 (97)	2.50±0.05 (100)	0.96±0.01 (96)	2.46±0.04 (98)	0.247±0.003 (99)	2.43±0.05 (97)	0.226±0.005 (90)	0.91±0.03 (91)
Tm	1.01±0.02 (101)	2.49±0.04 (100)	0.249±0.005 (100)	2.52±0.05 (101)	0.249±0.004 (100)	0.98±0.01 (98)	0.240±0.005 (96)	0.95±0.02 (95)	2.43±0.05 (97)
Yb	2.47±0.04 (99)	0.250±0.003 (100)	1.00±0.01 (100)	0.250±0.003 (100)	0.99±0.02 (99)	2.45±0.04 (98)	0.88±0.03 (88)	2.31±0.05 (92)	0.221±0.005 (88)
Lu	0.248±0.004 (99)	0.99±0.01 (99)	2.53±0.05 (101)	0.99±0.01 (99)	2.48±0.04 (99)	0.250±0.005 (100)	2.42±0.006 (97)	0.240±0.004 (96)	0.95±0.02 (95)

Note: The percentage recoveries are given in parenthesis.

Table T4:

Element	Emission line (nm)	Interference from nearby Gd emission line(s) (nm)
Ce	418.66	418.425
Pr	417.939	417.356
Nd	401.225	401.38
Sm	388.529	388.184
Tb	332.44	332.044 and 332.934
Ho	345.6	345.038, 345.23, 345.414 and 345.49

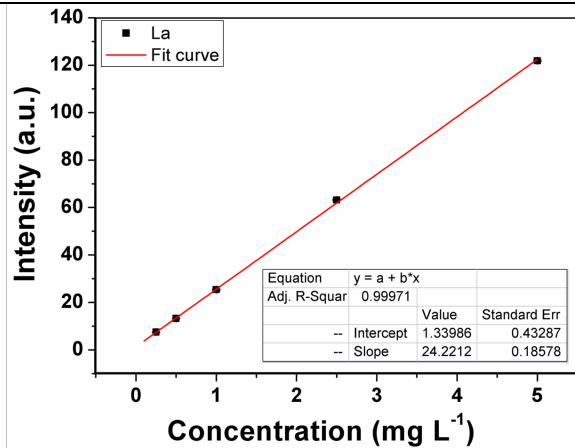


Fig. S1(a)

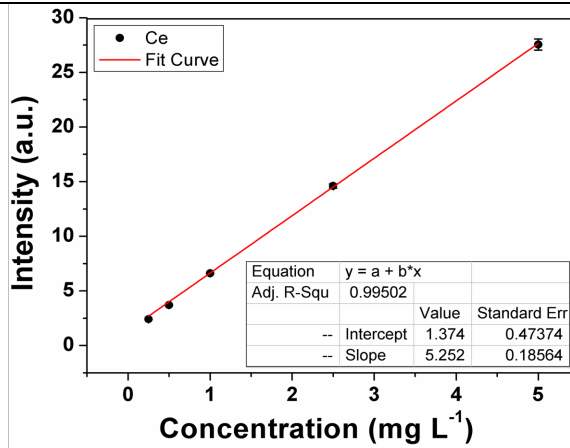


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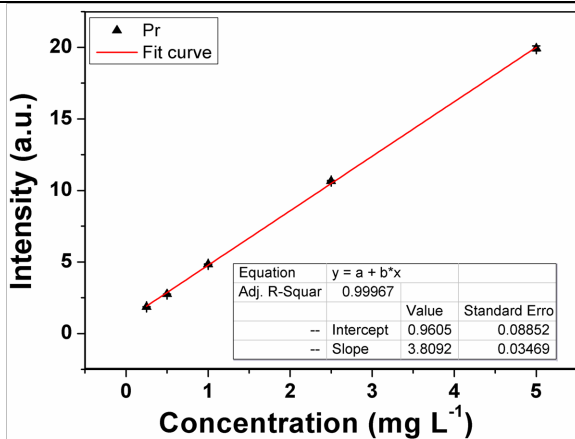


Fig. S1(c)

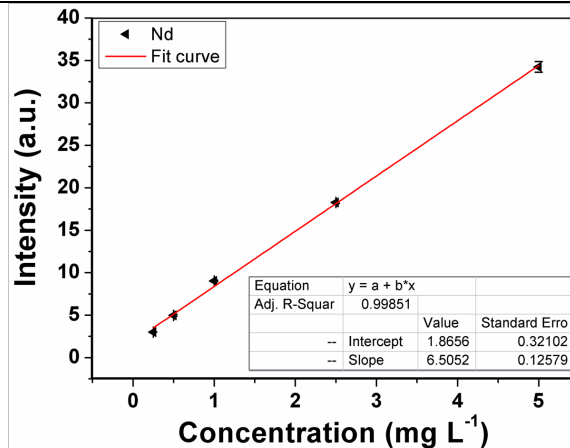


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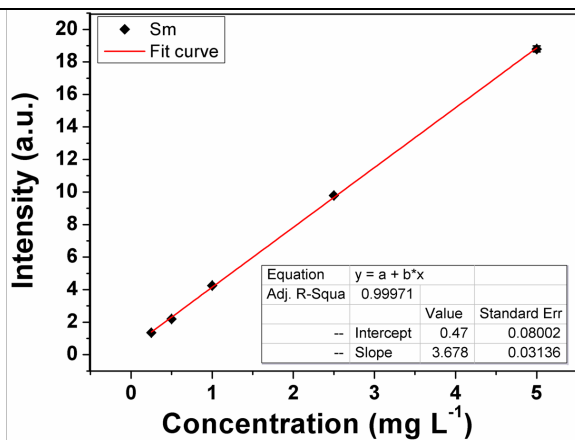


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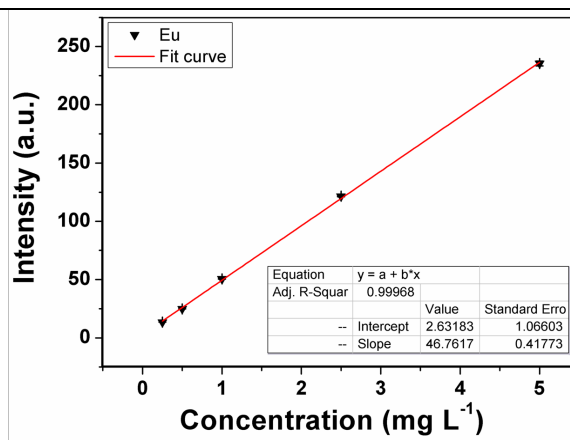


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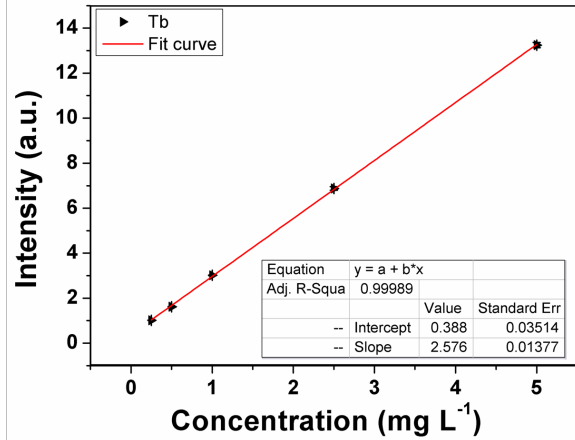


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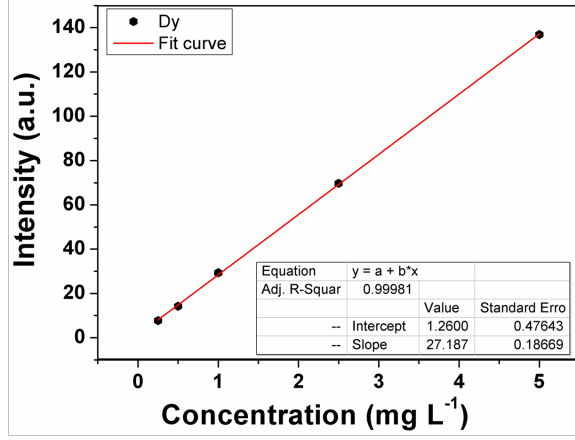


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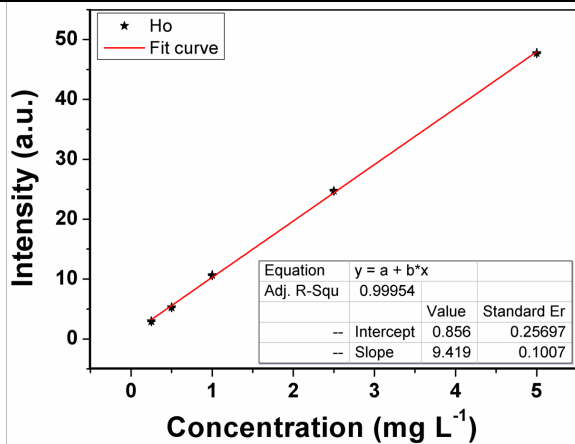


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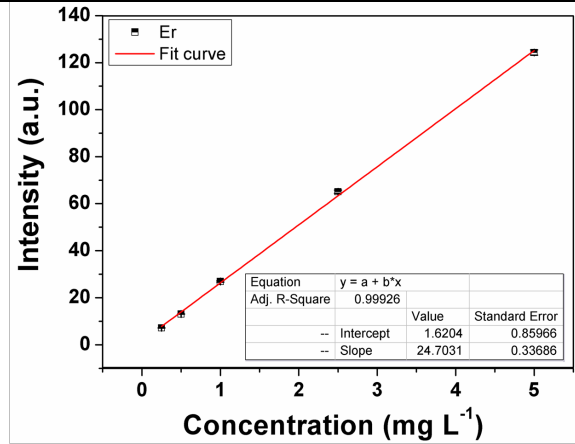


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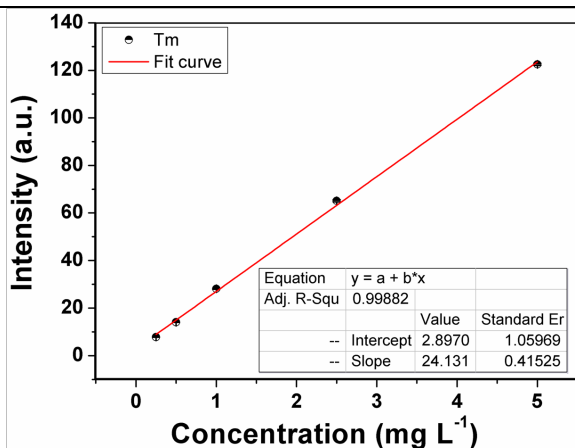


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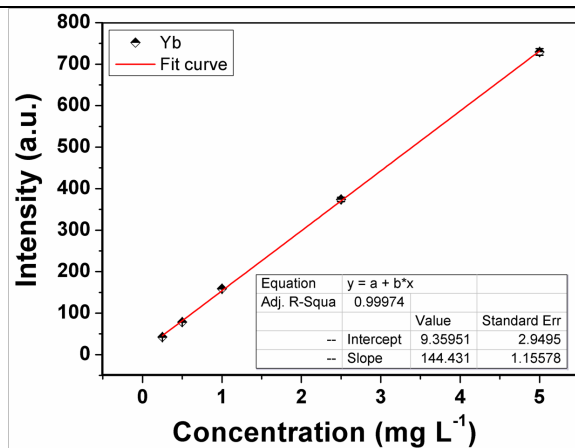


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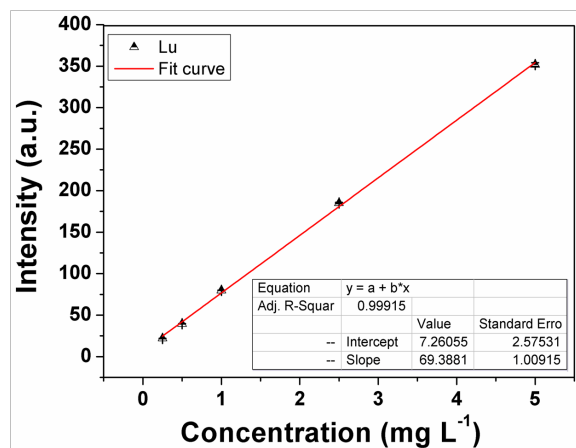


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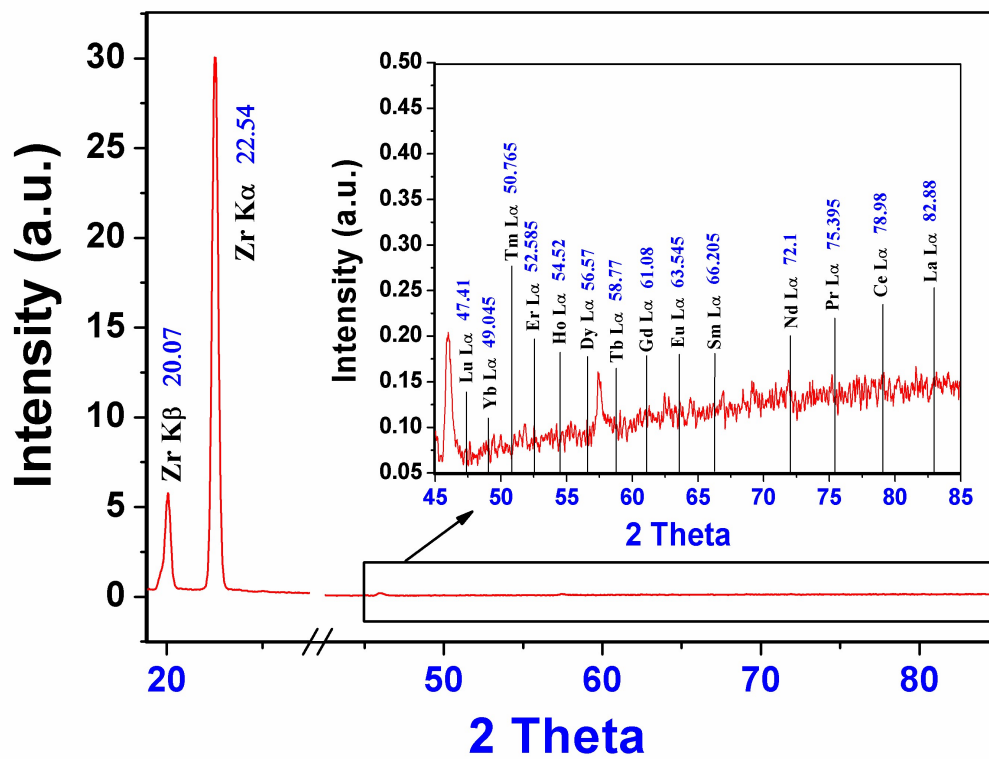


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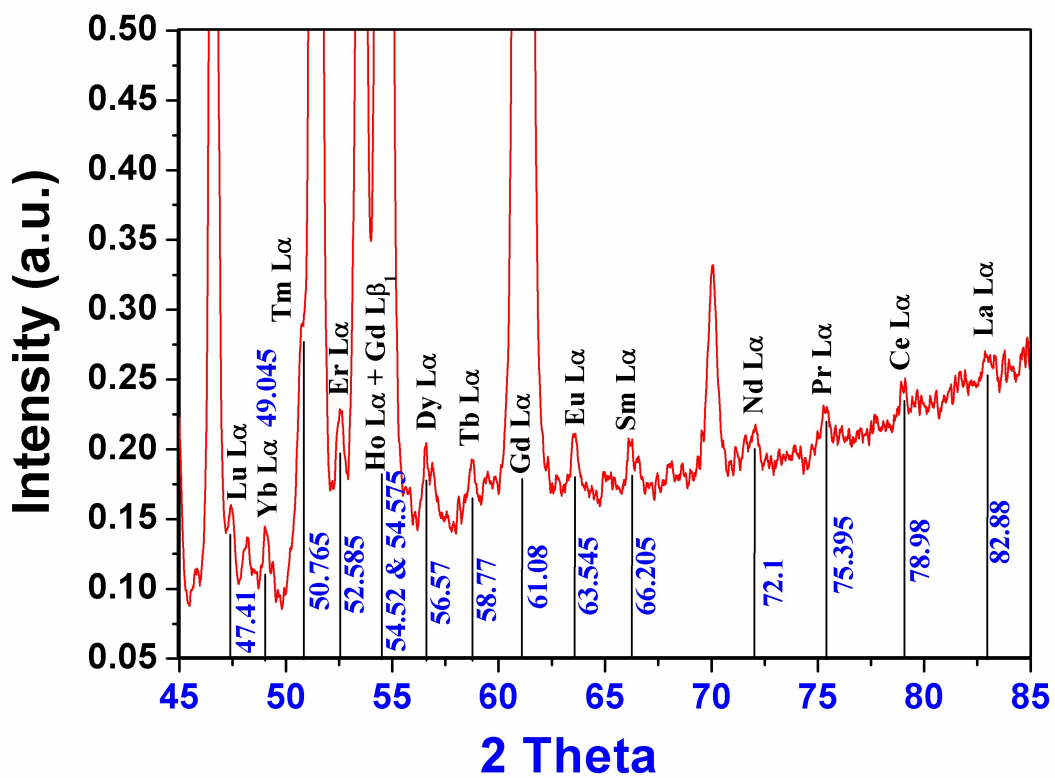


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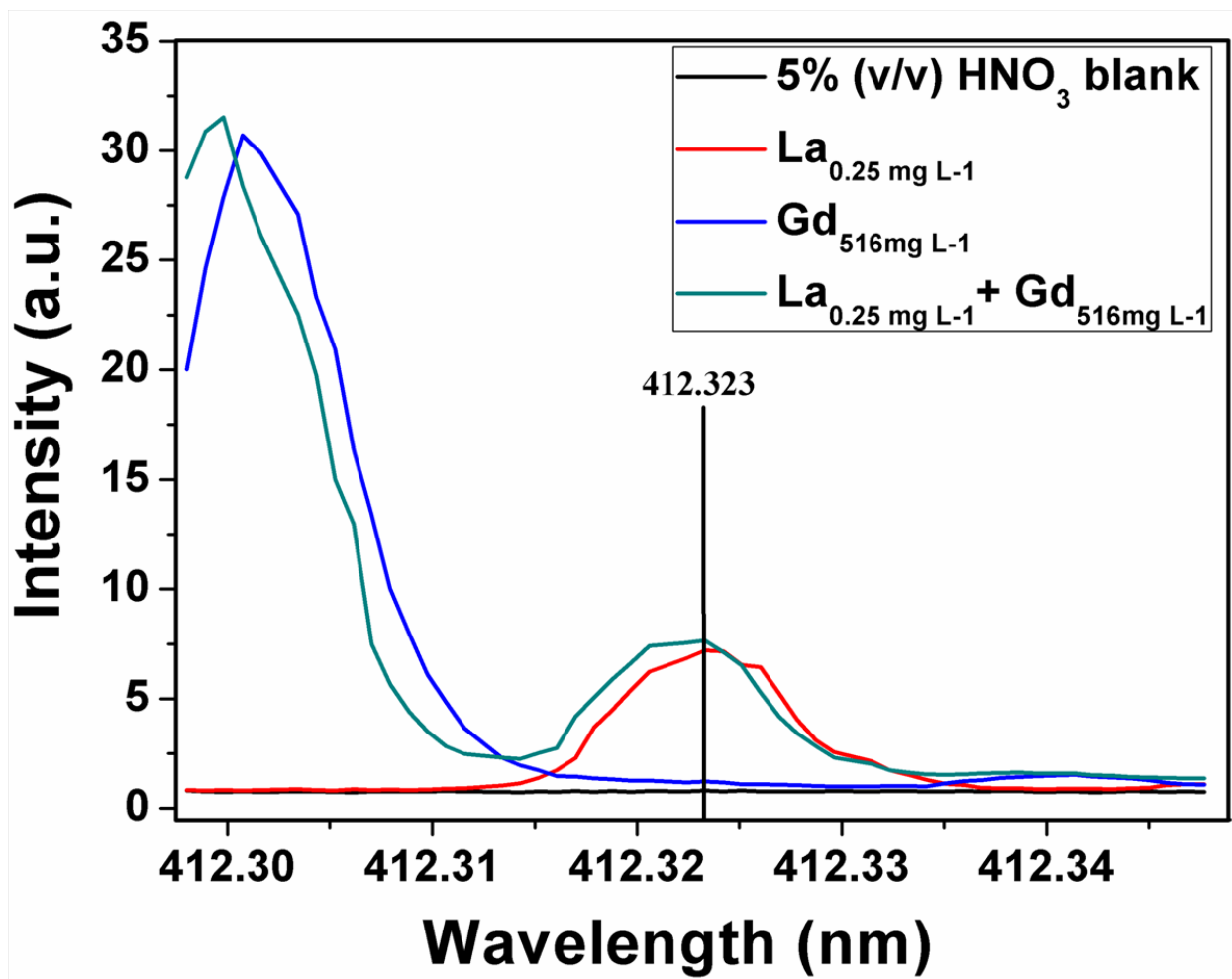


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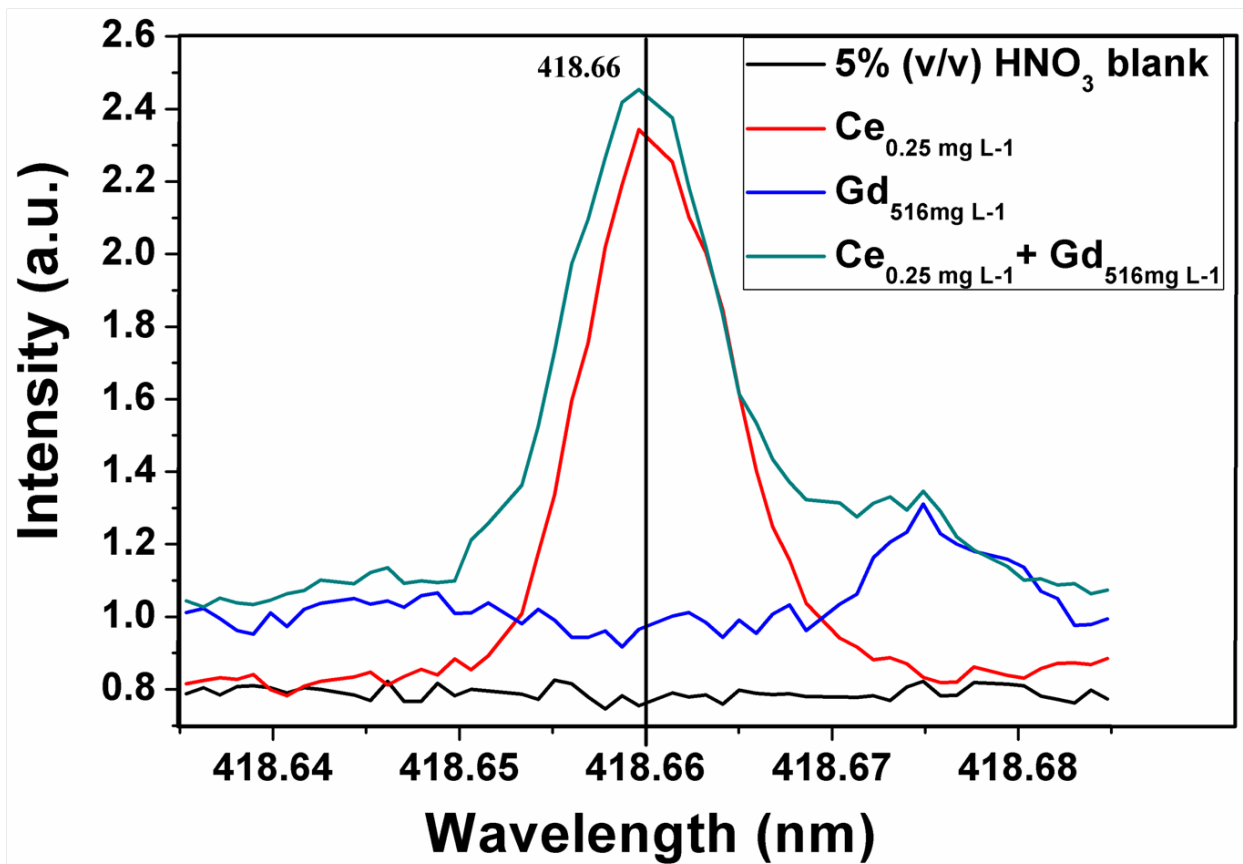


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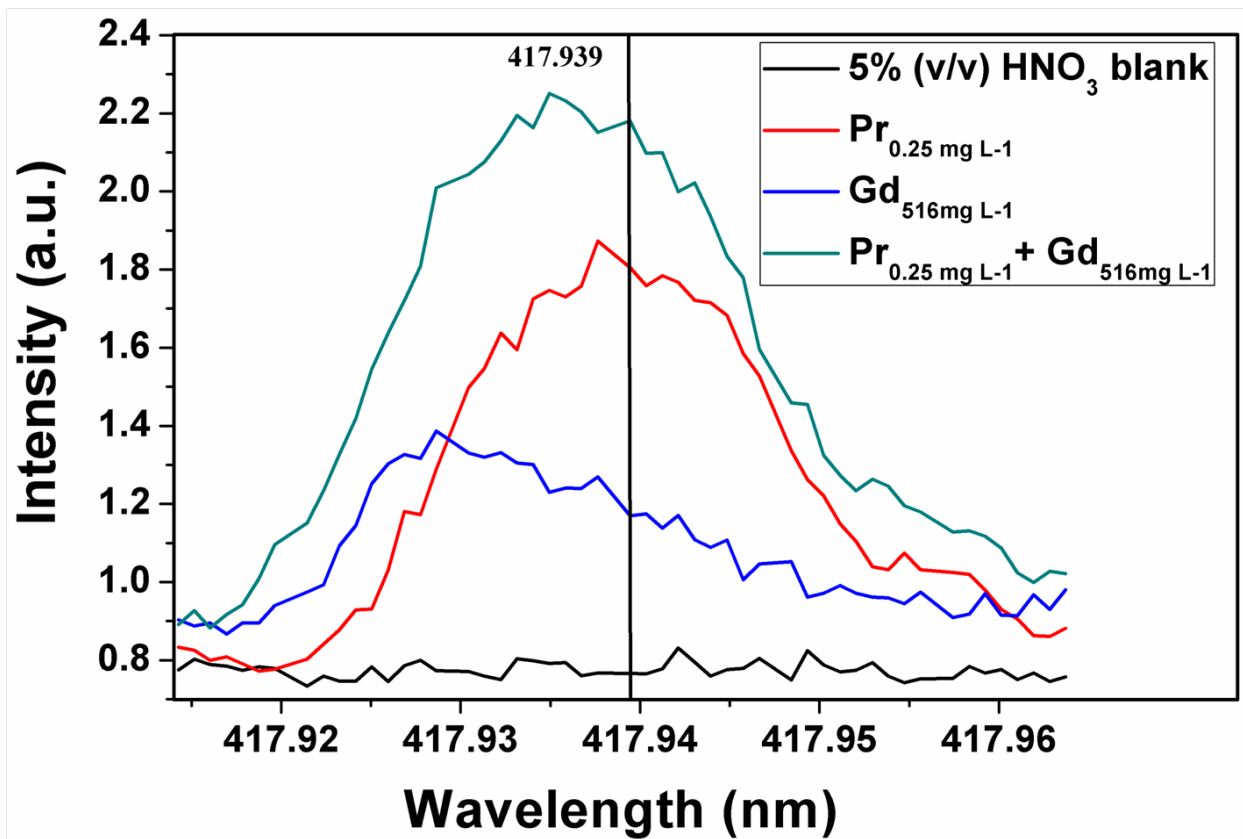


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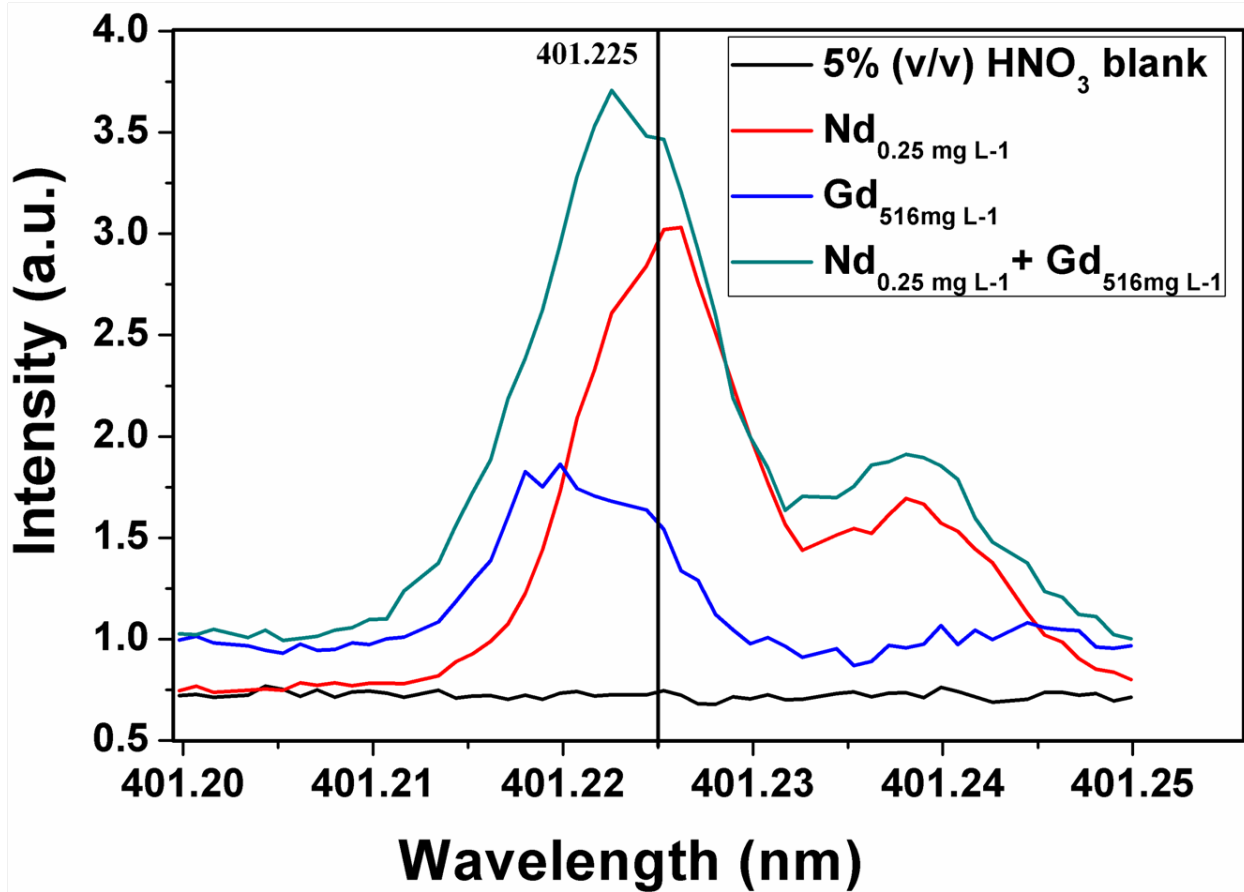


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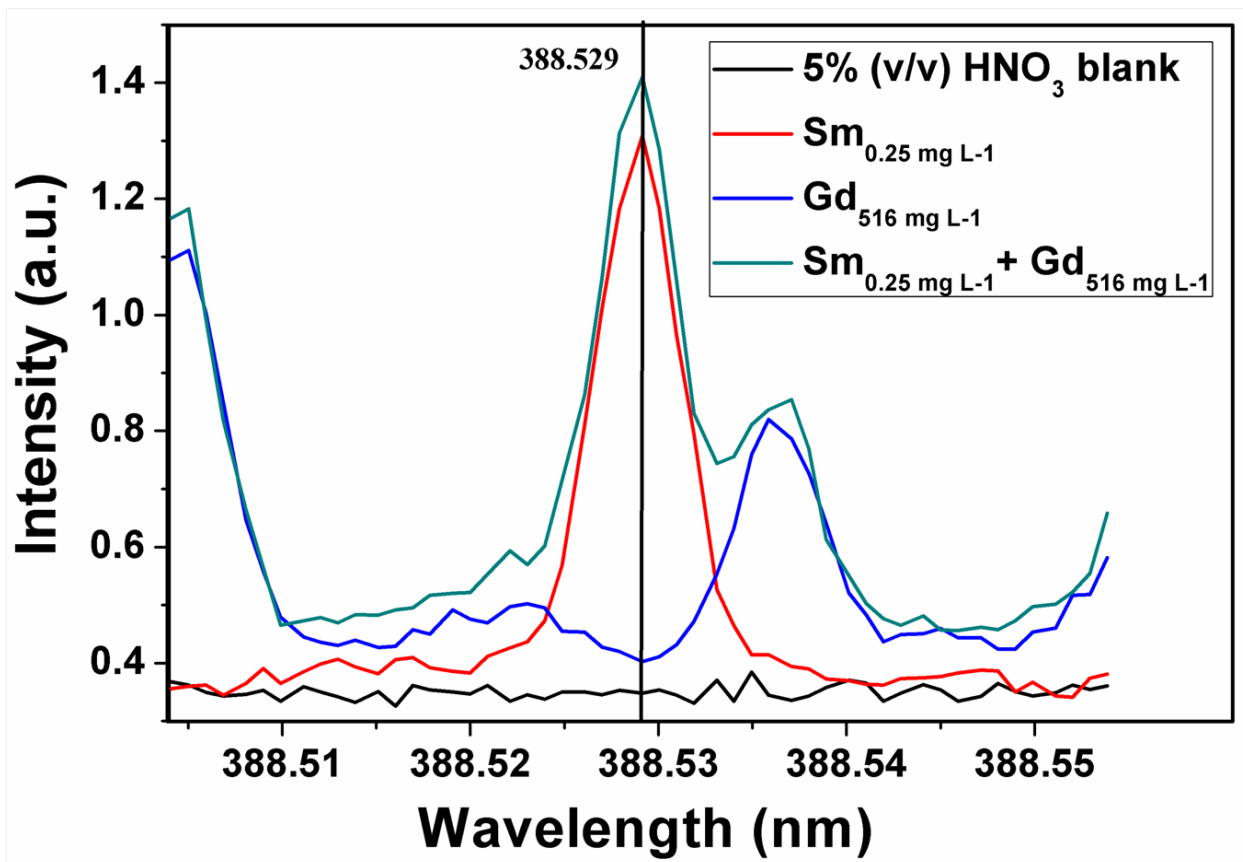


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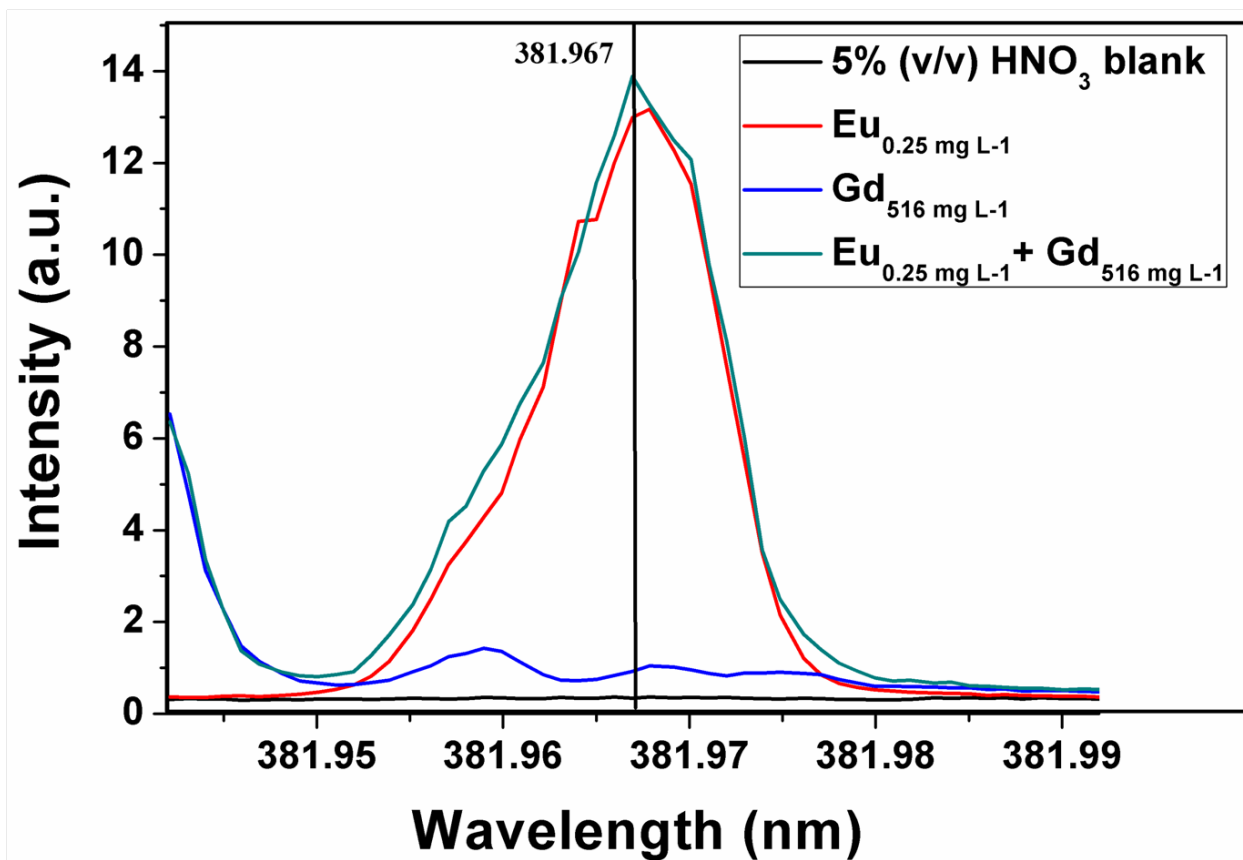


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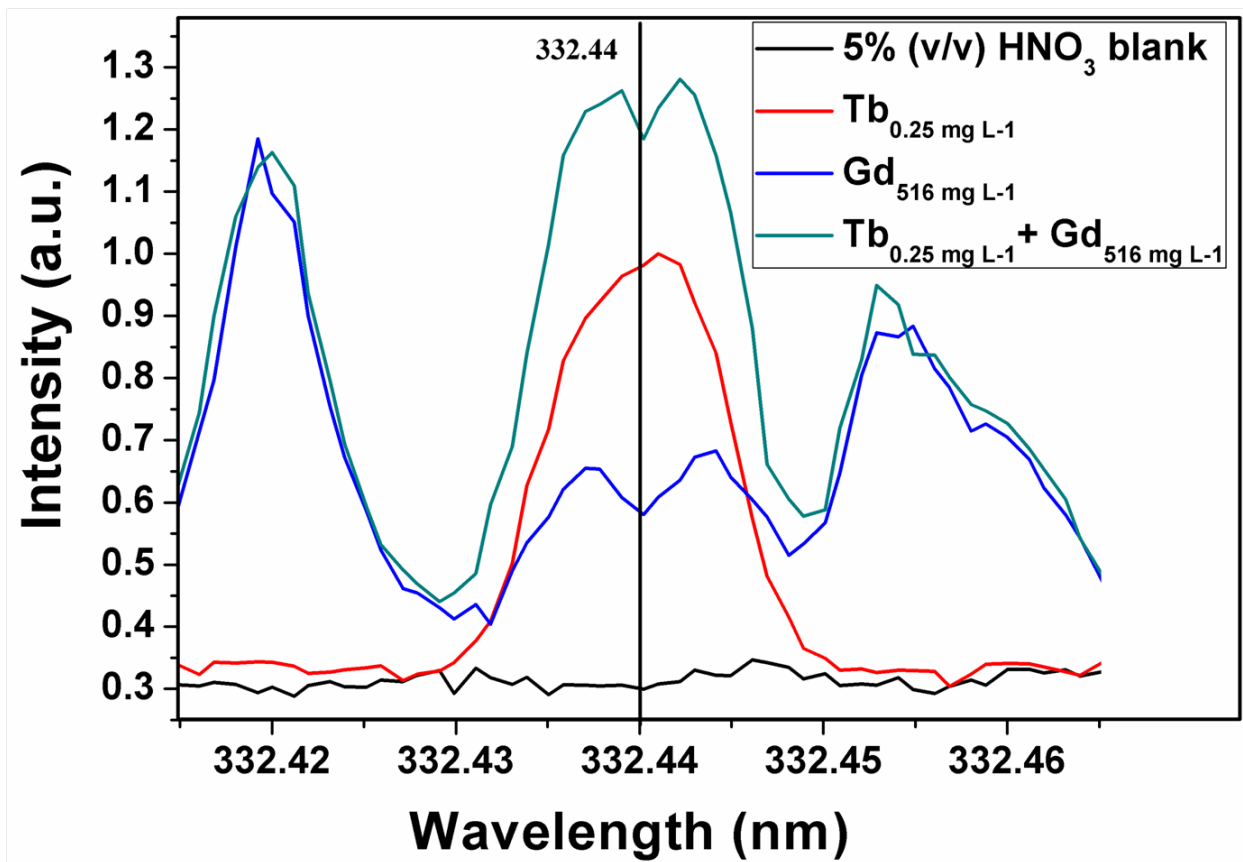


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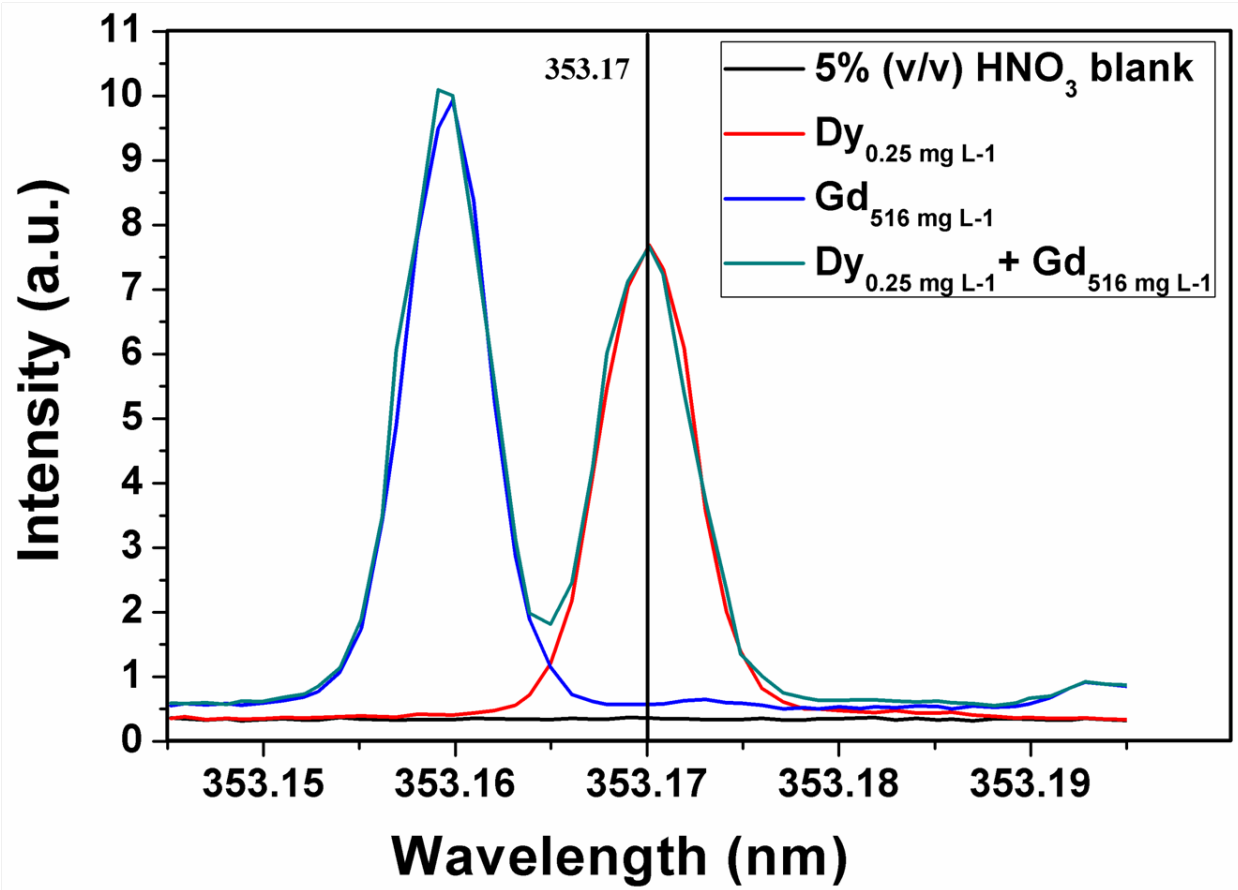


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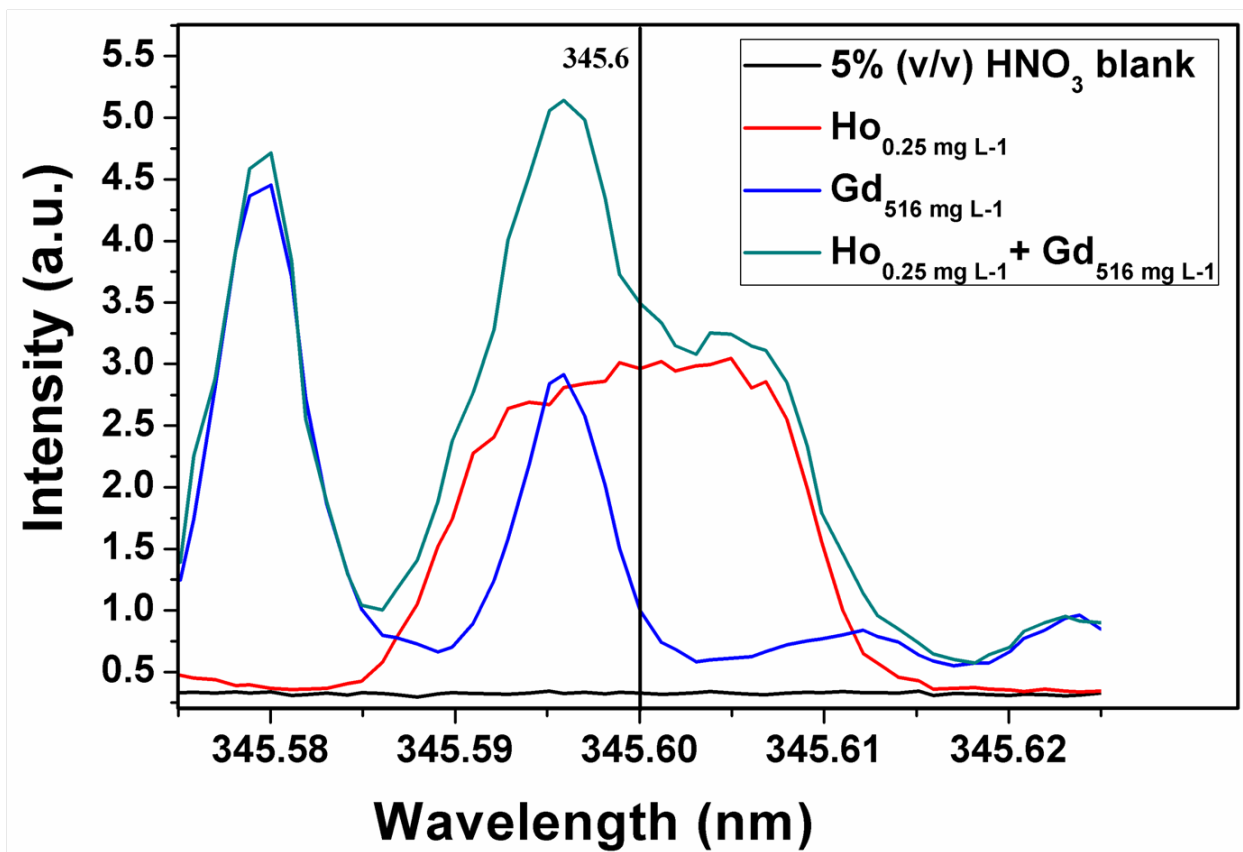


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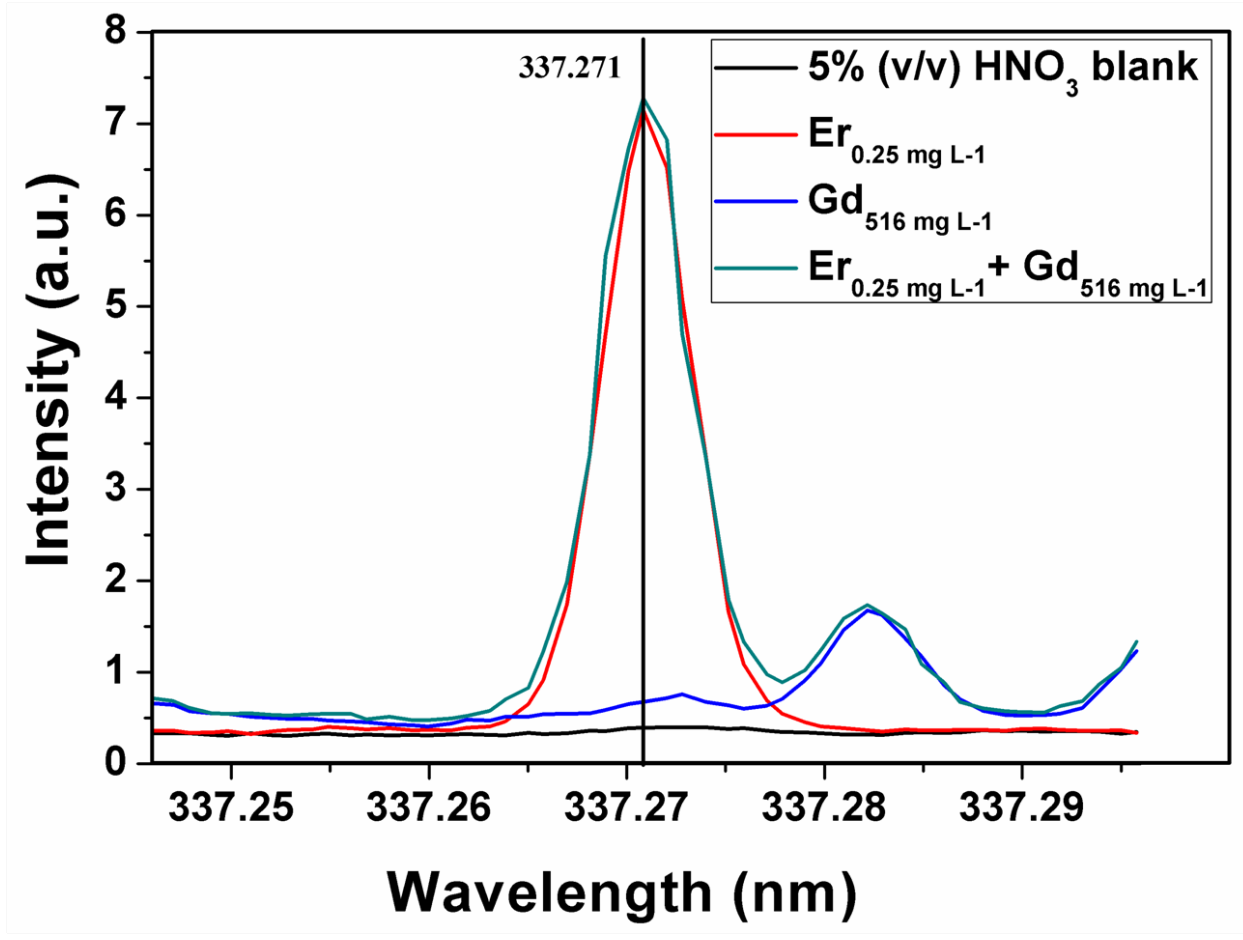


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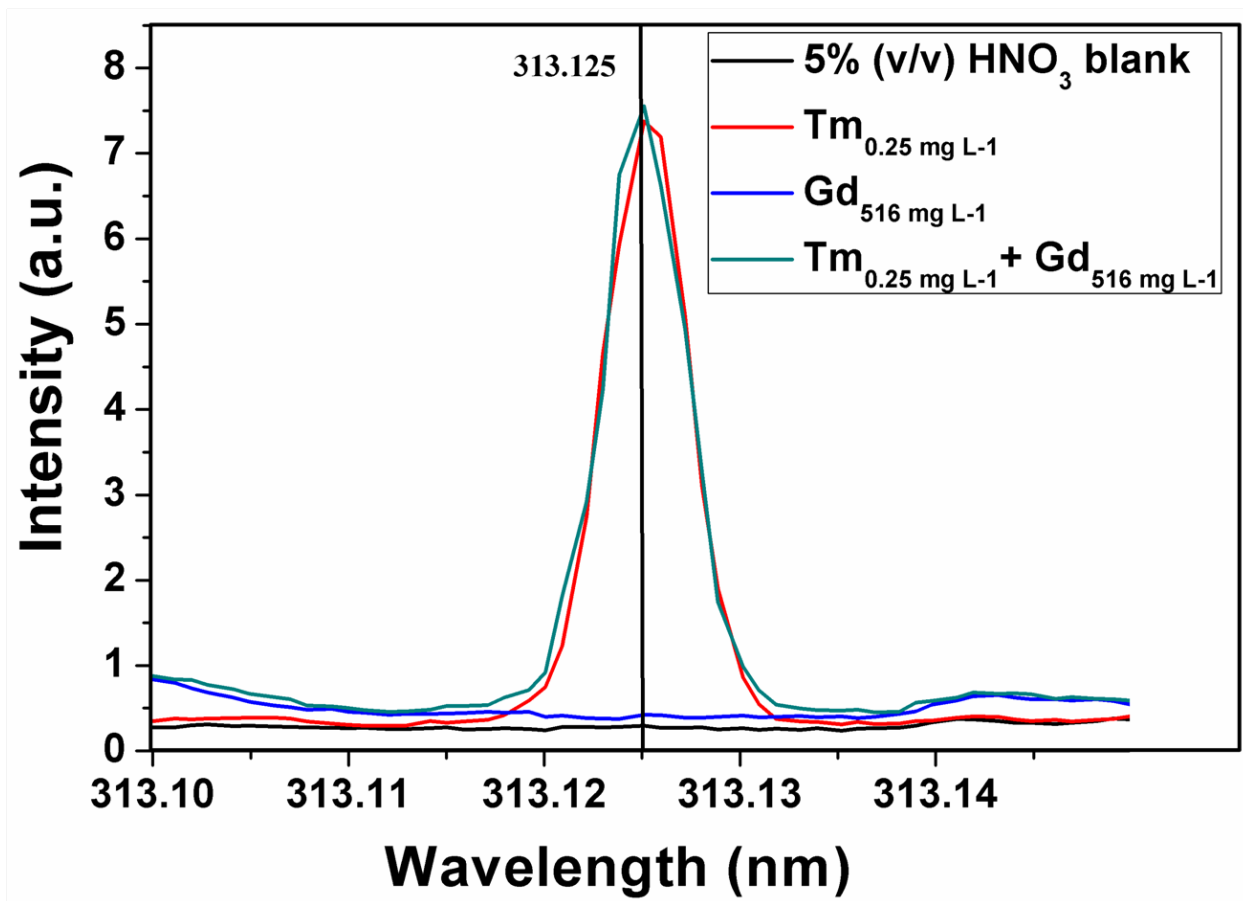


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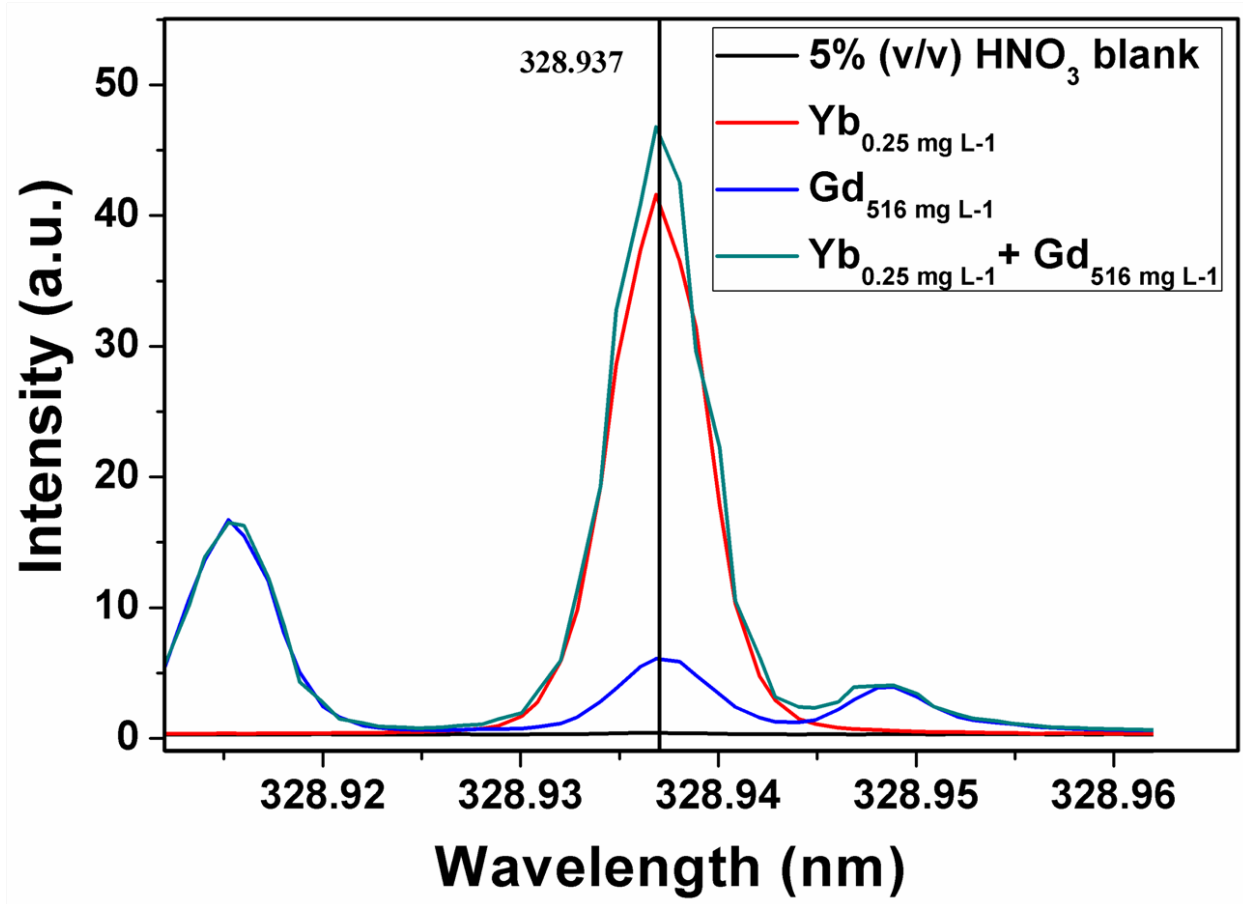


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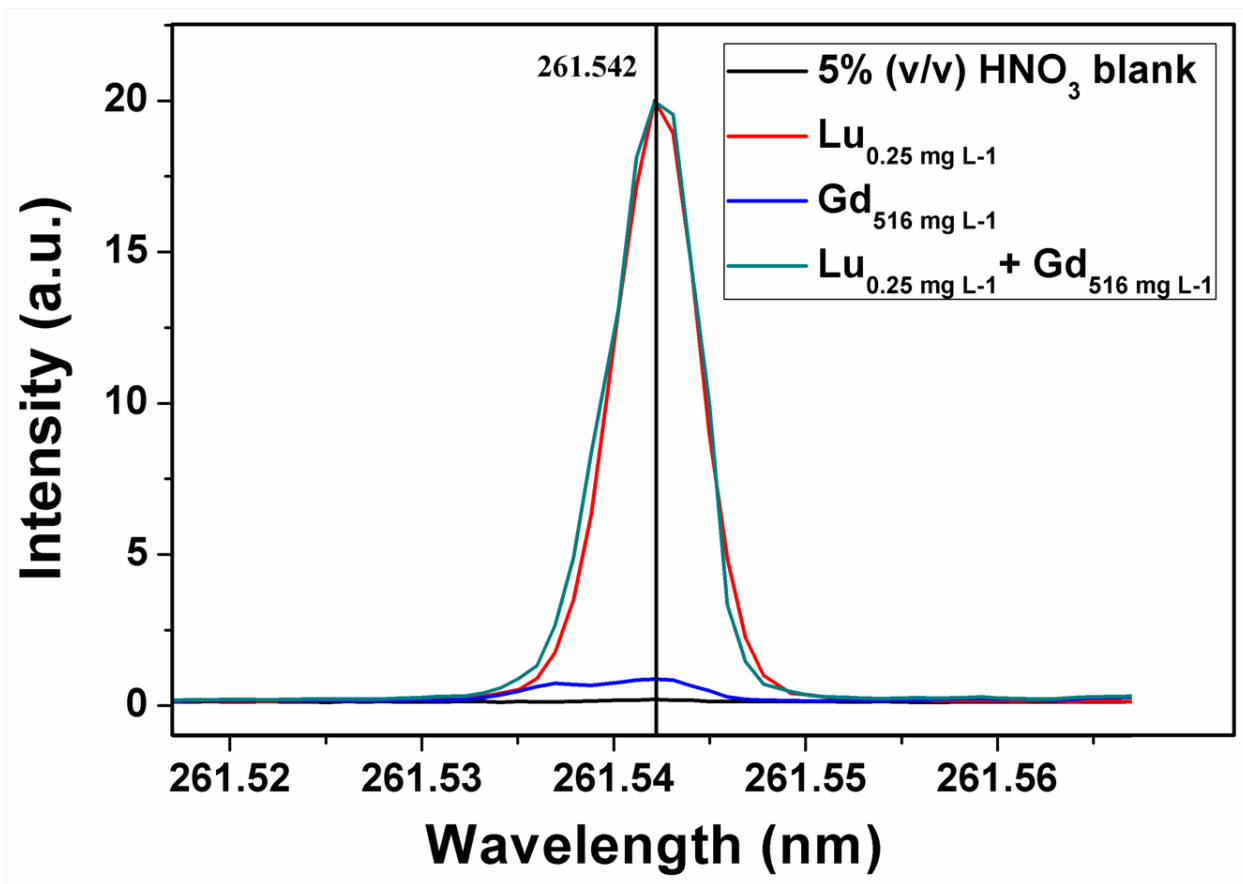


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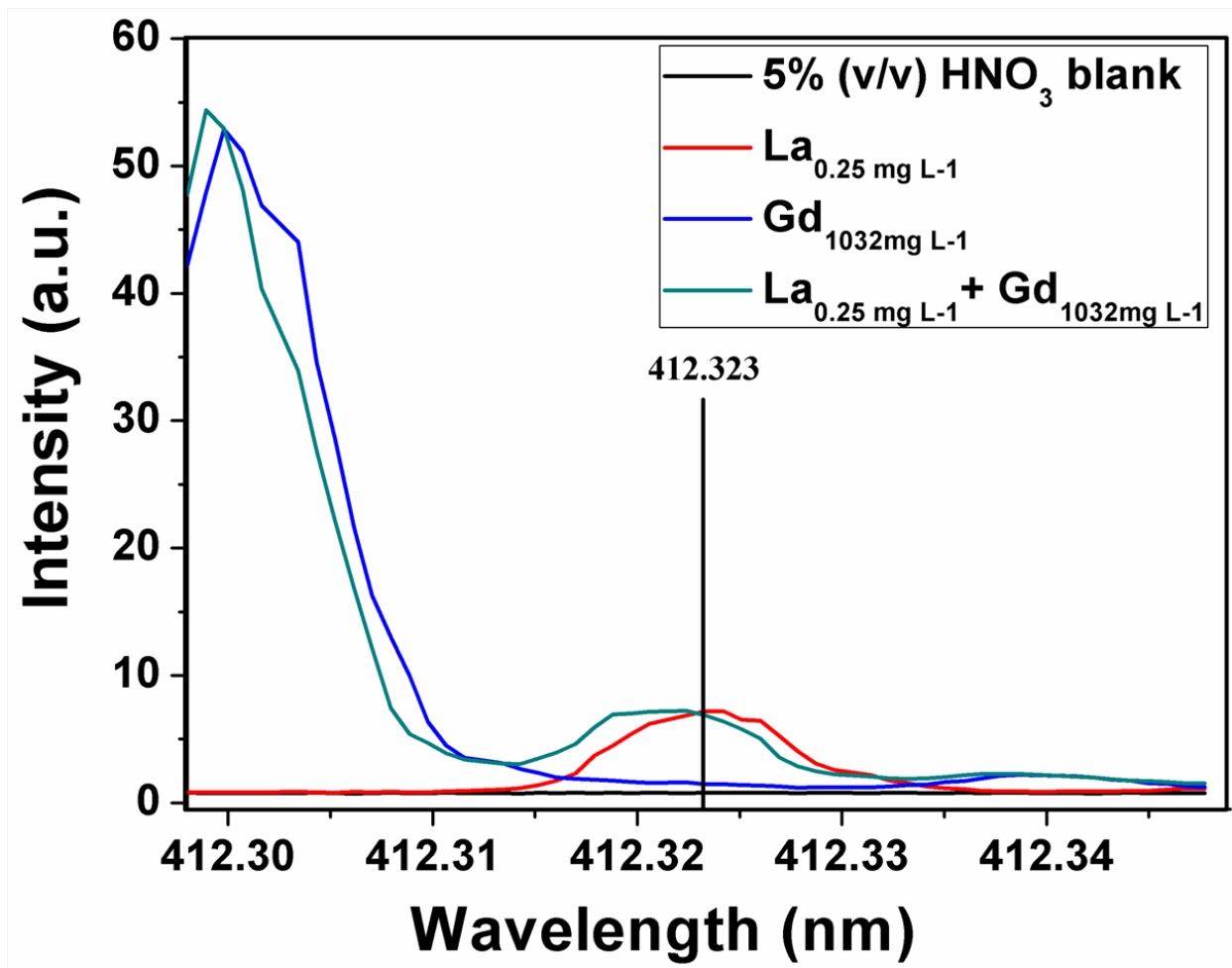


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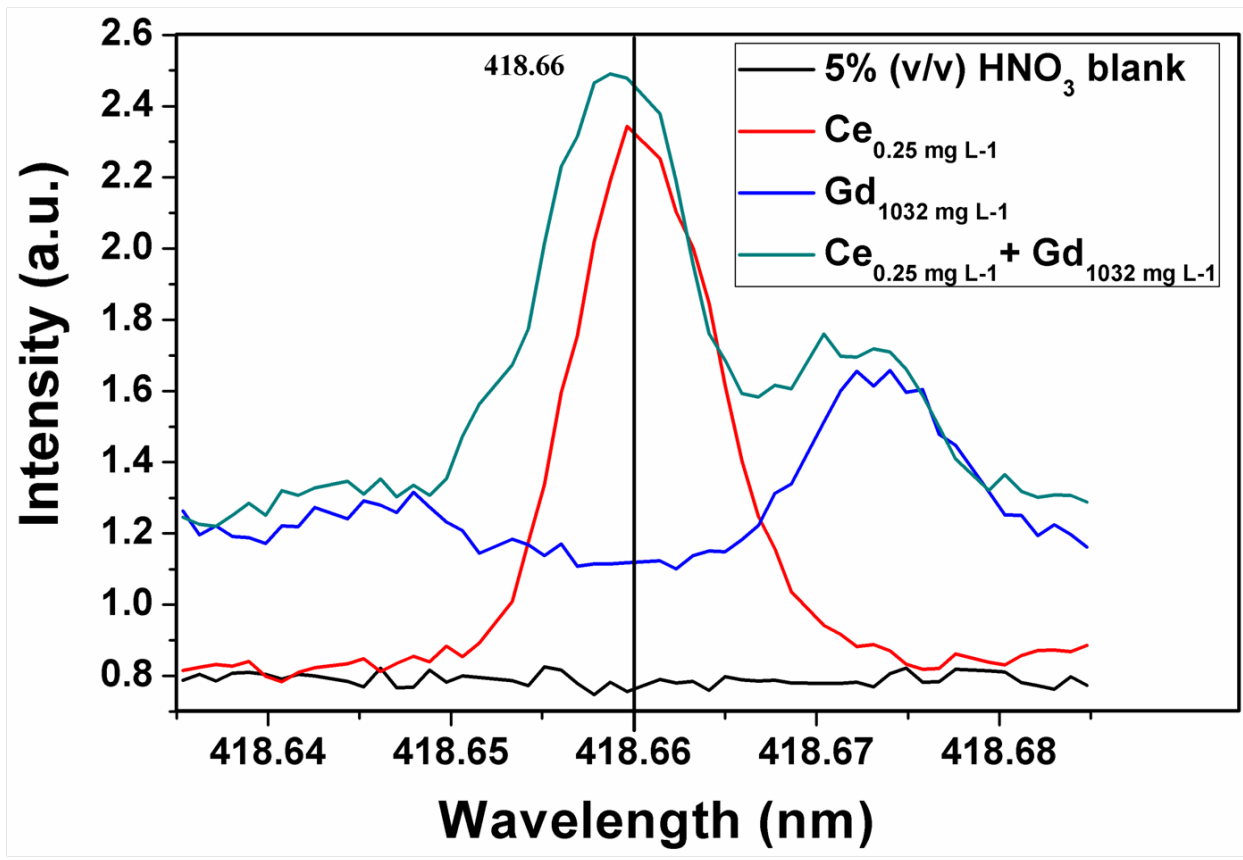


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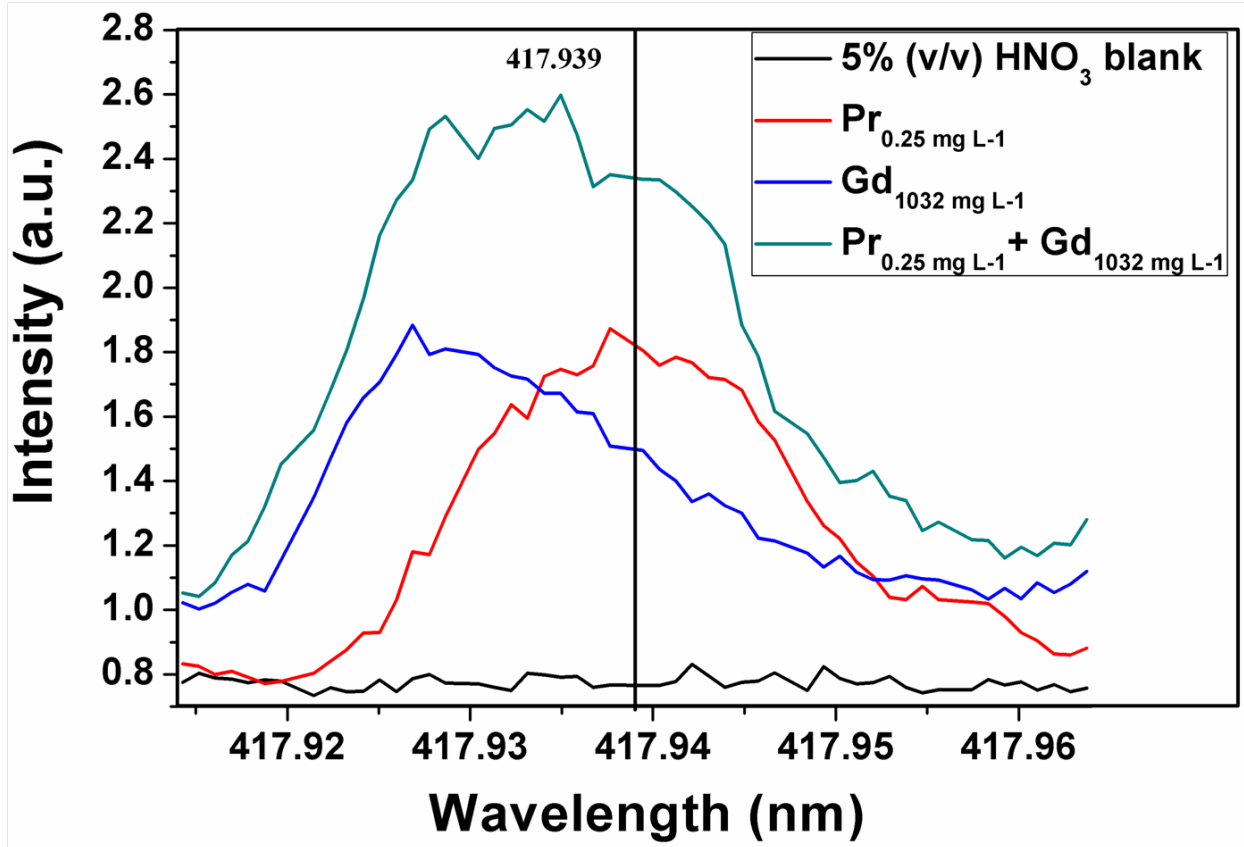


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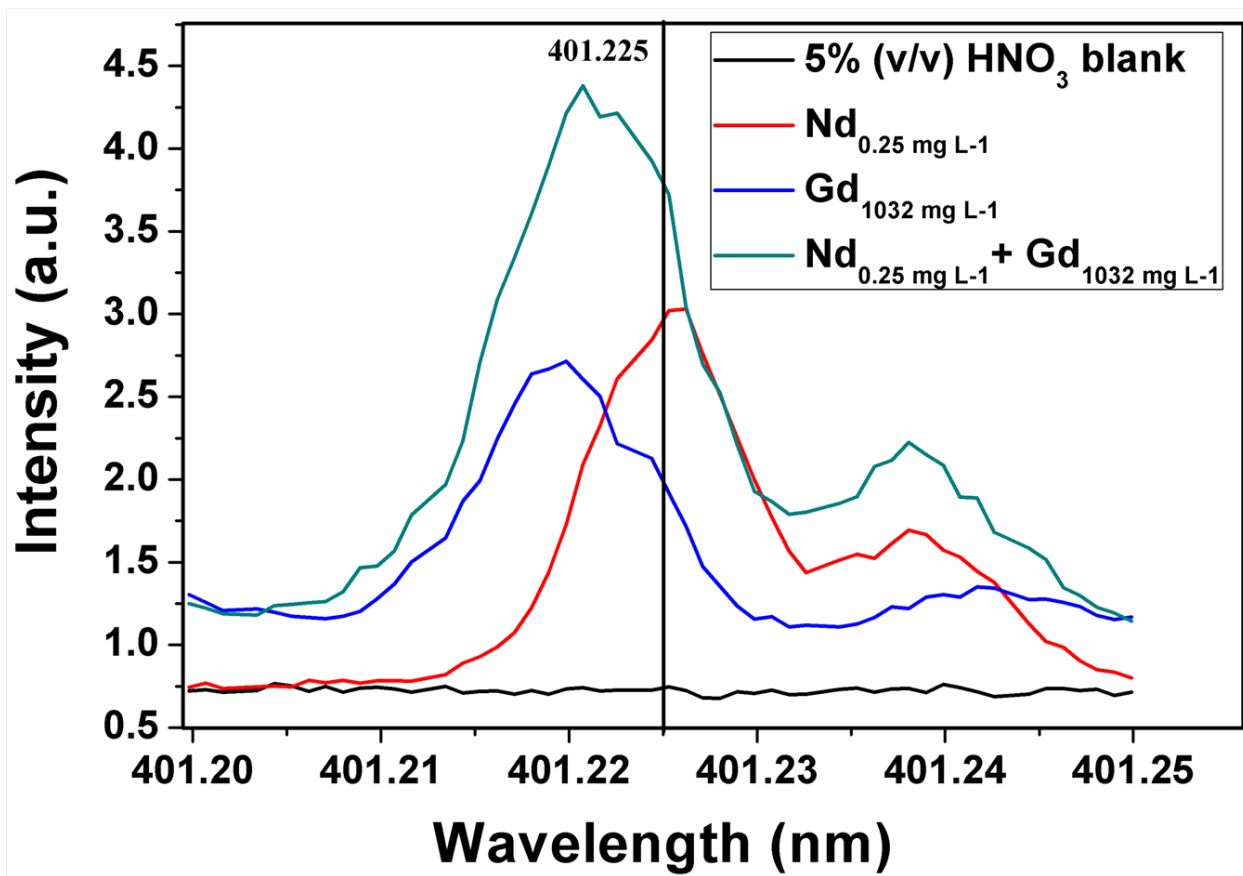


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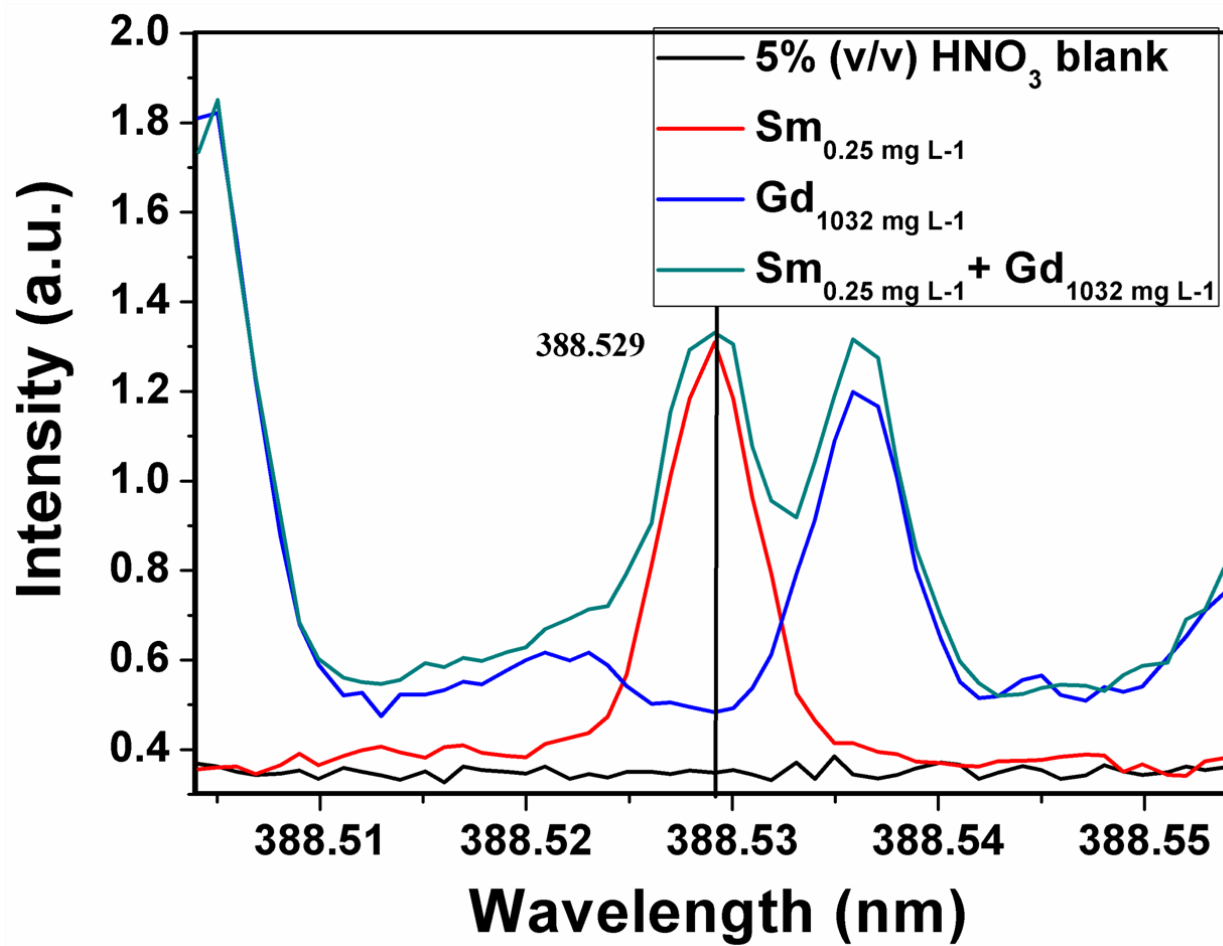


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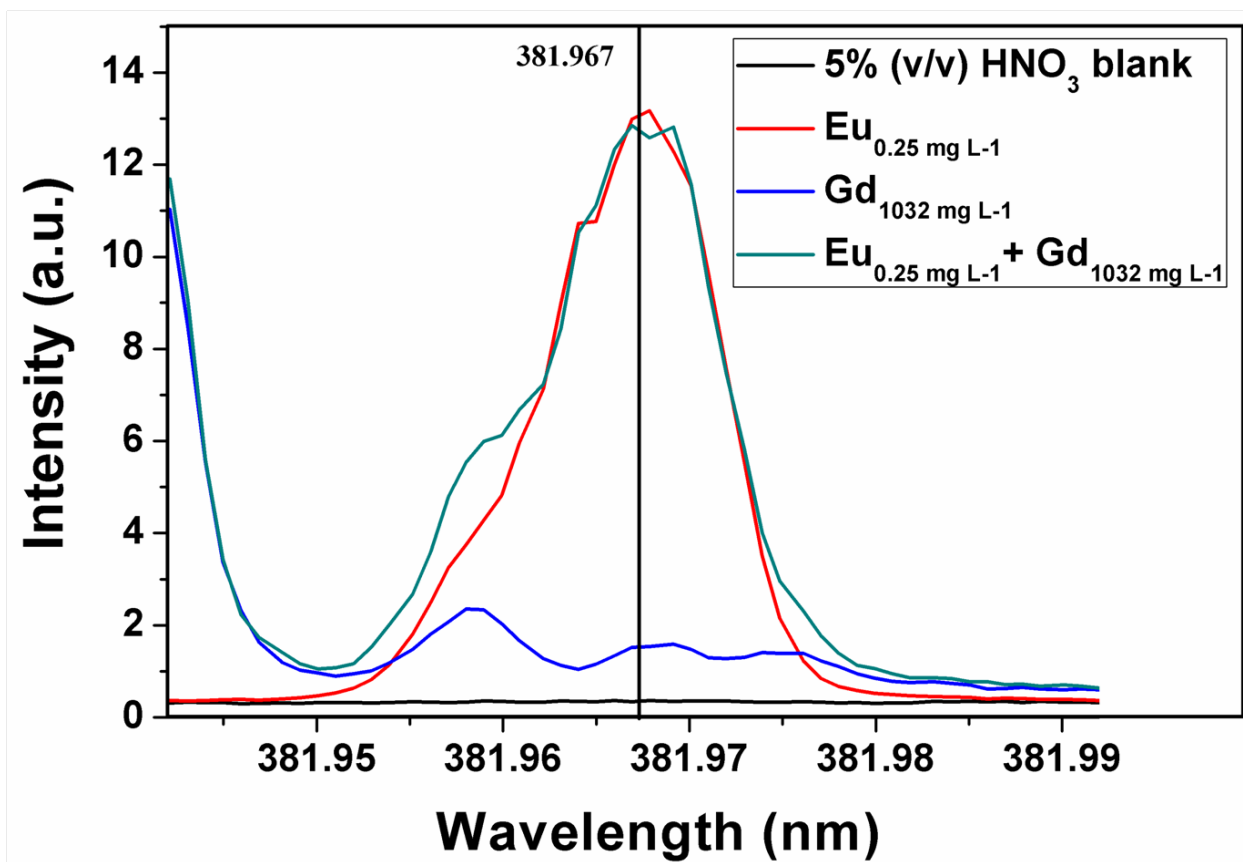


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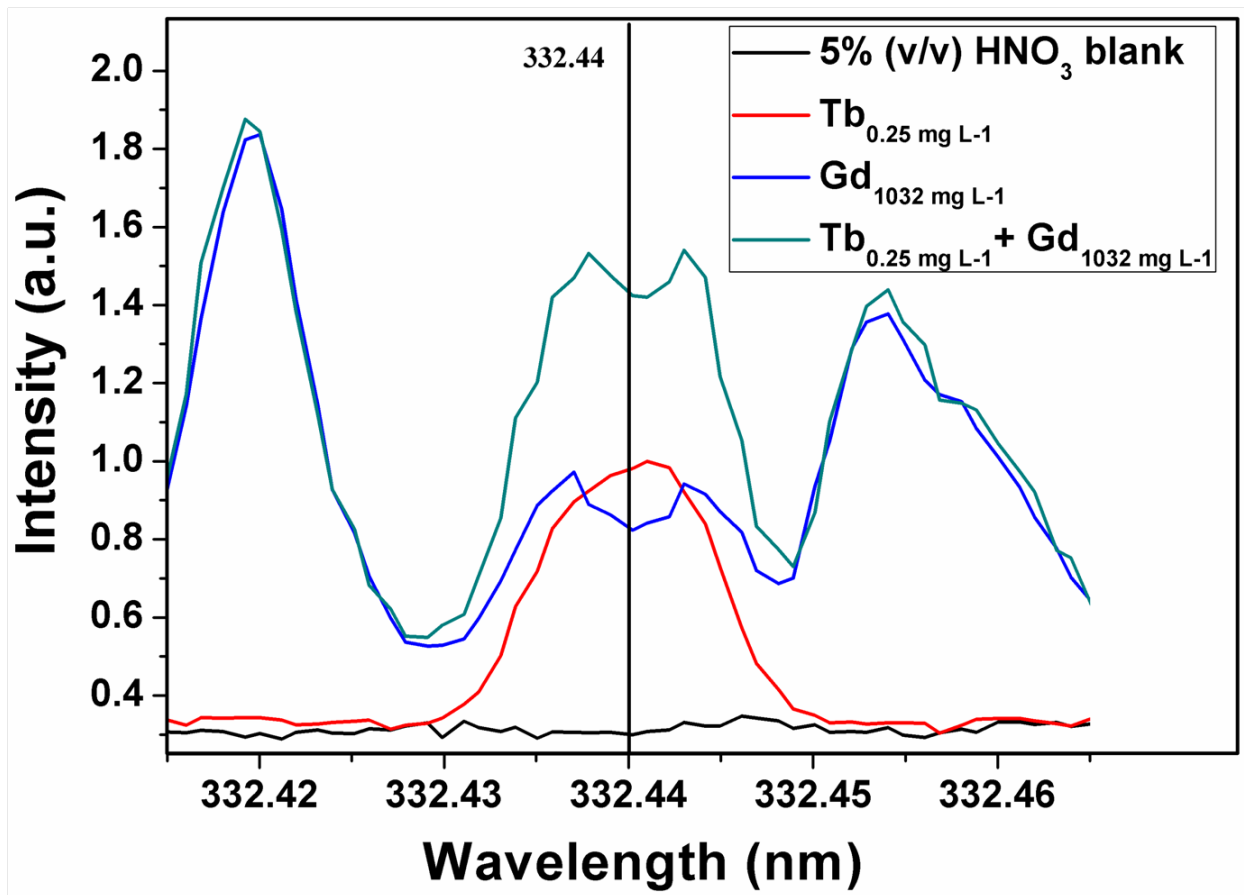


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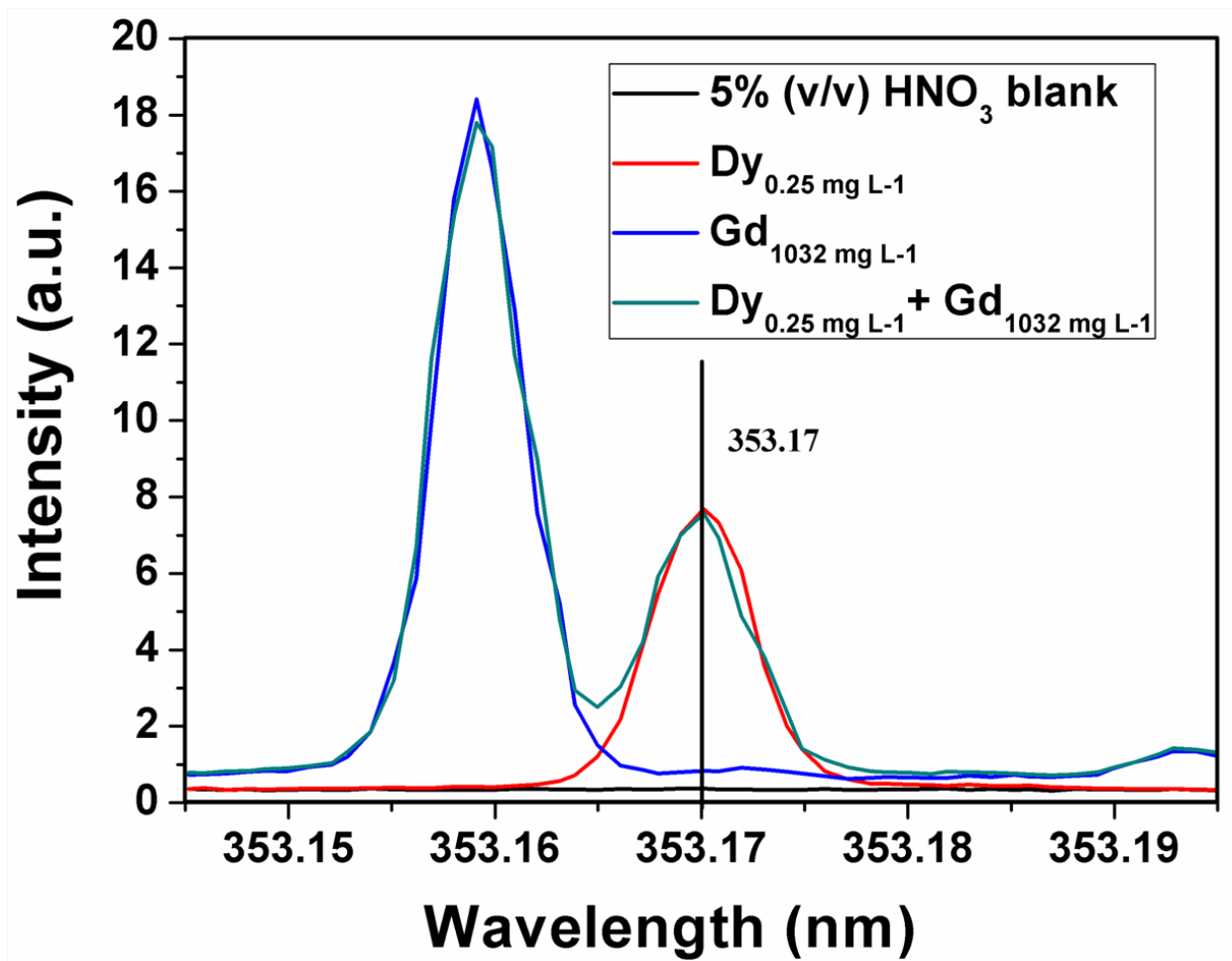


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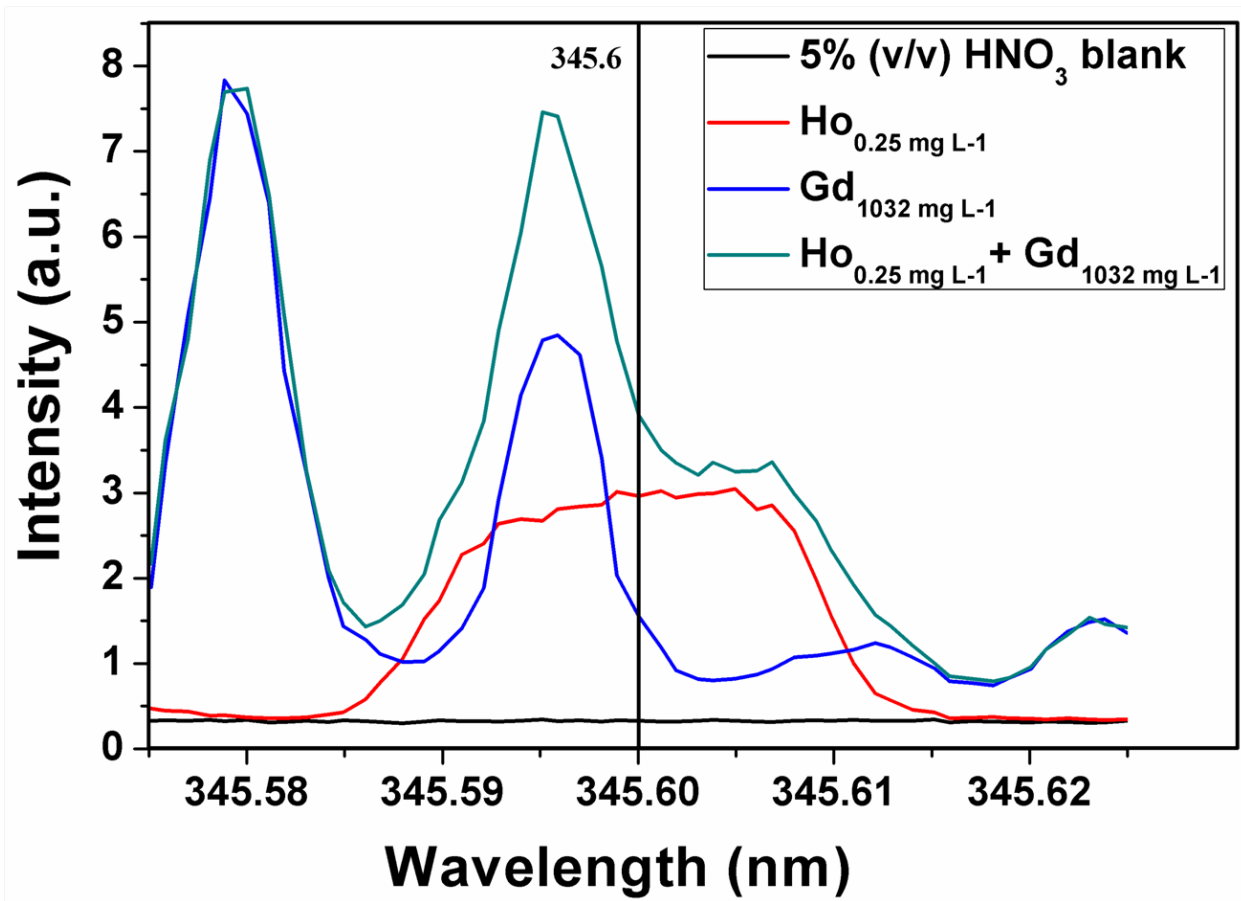


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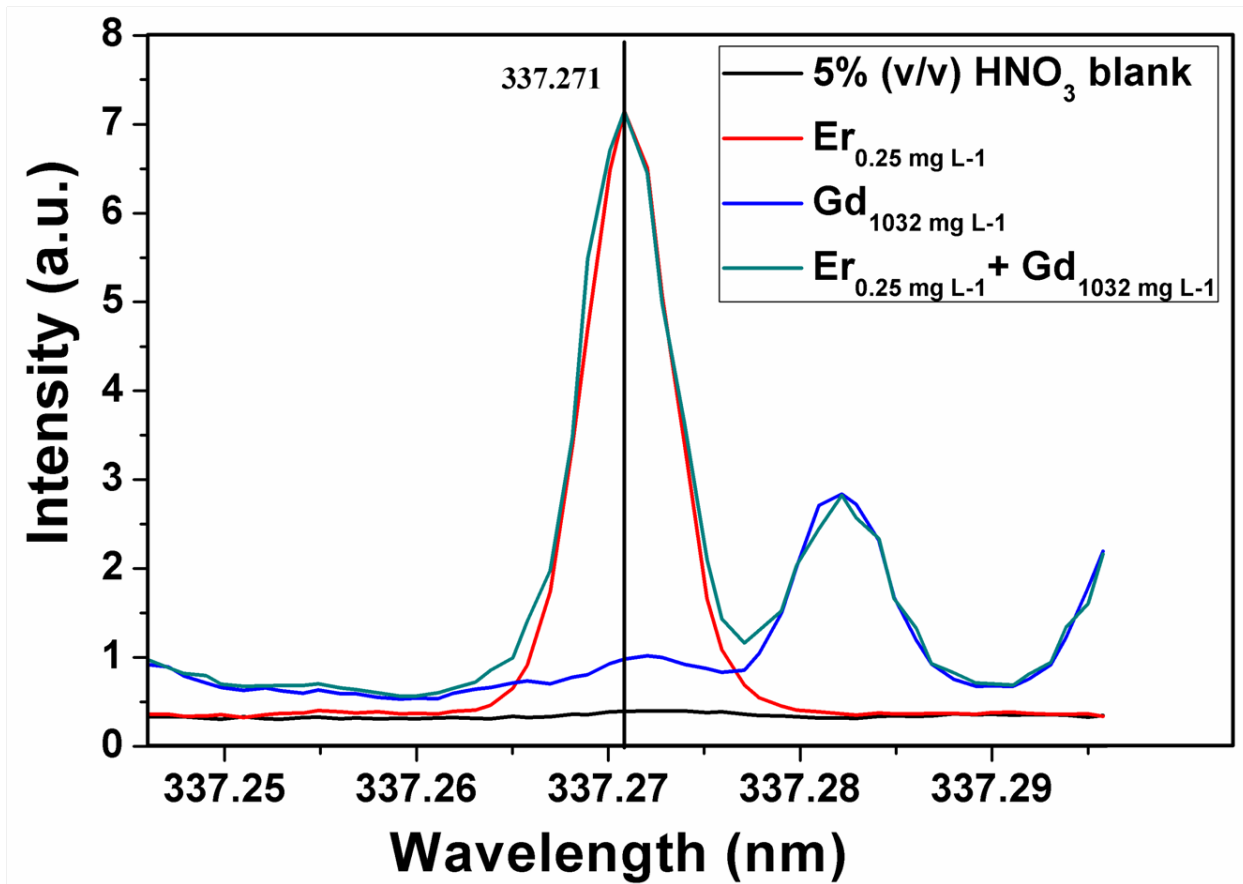


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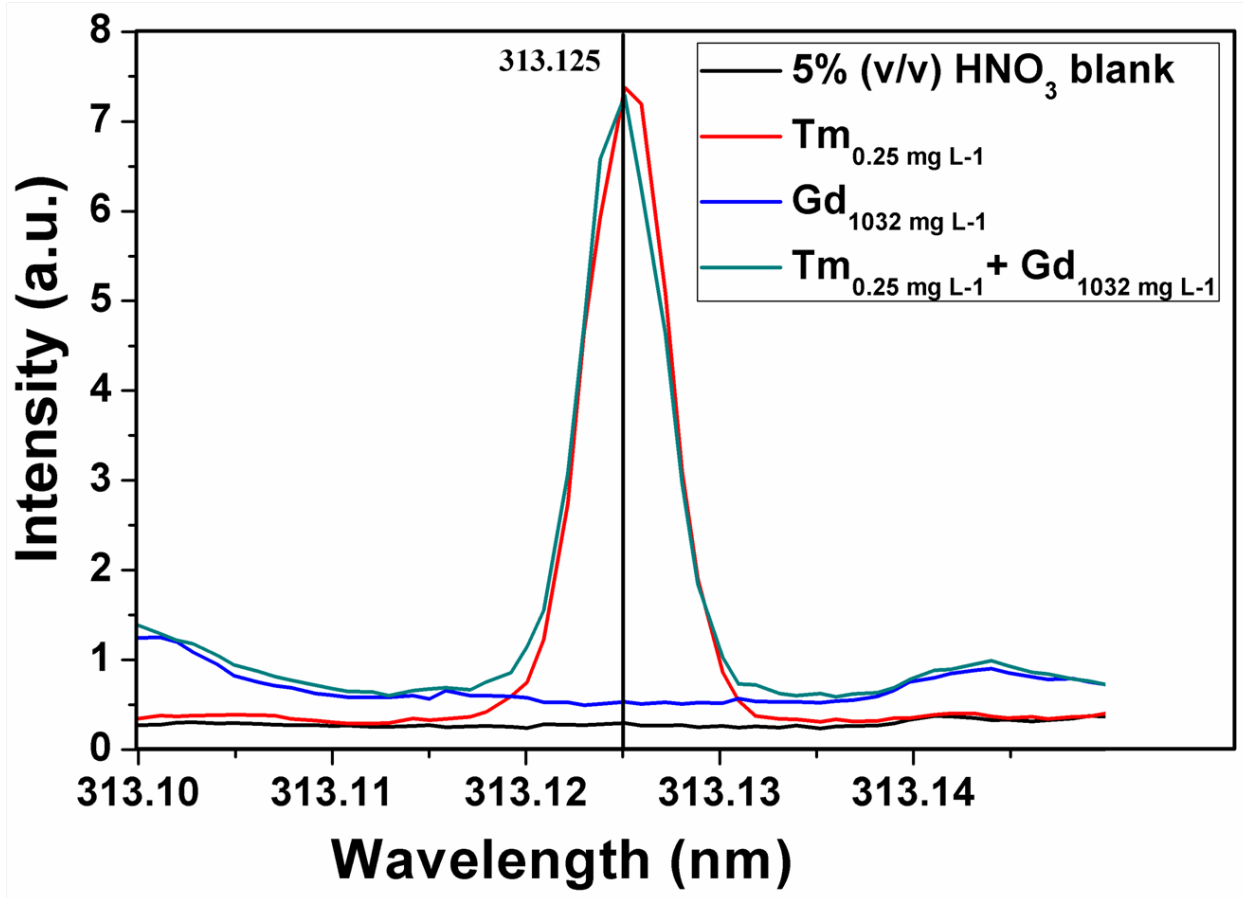


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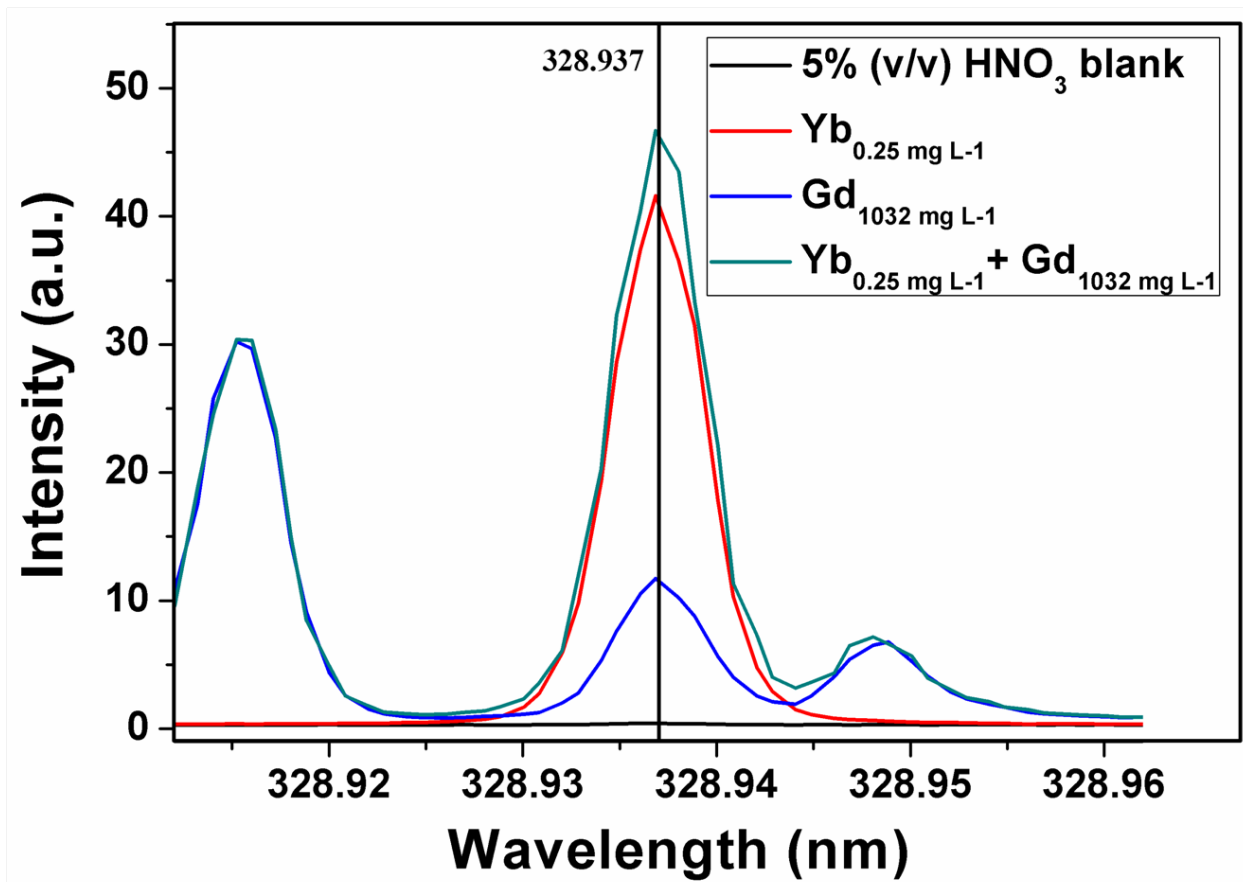


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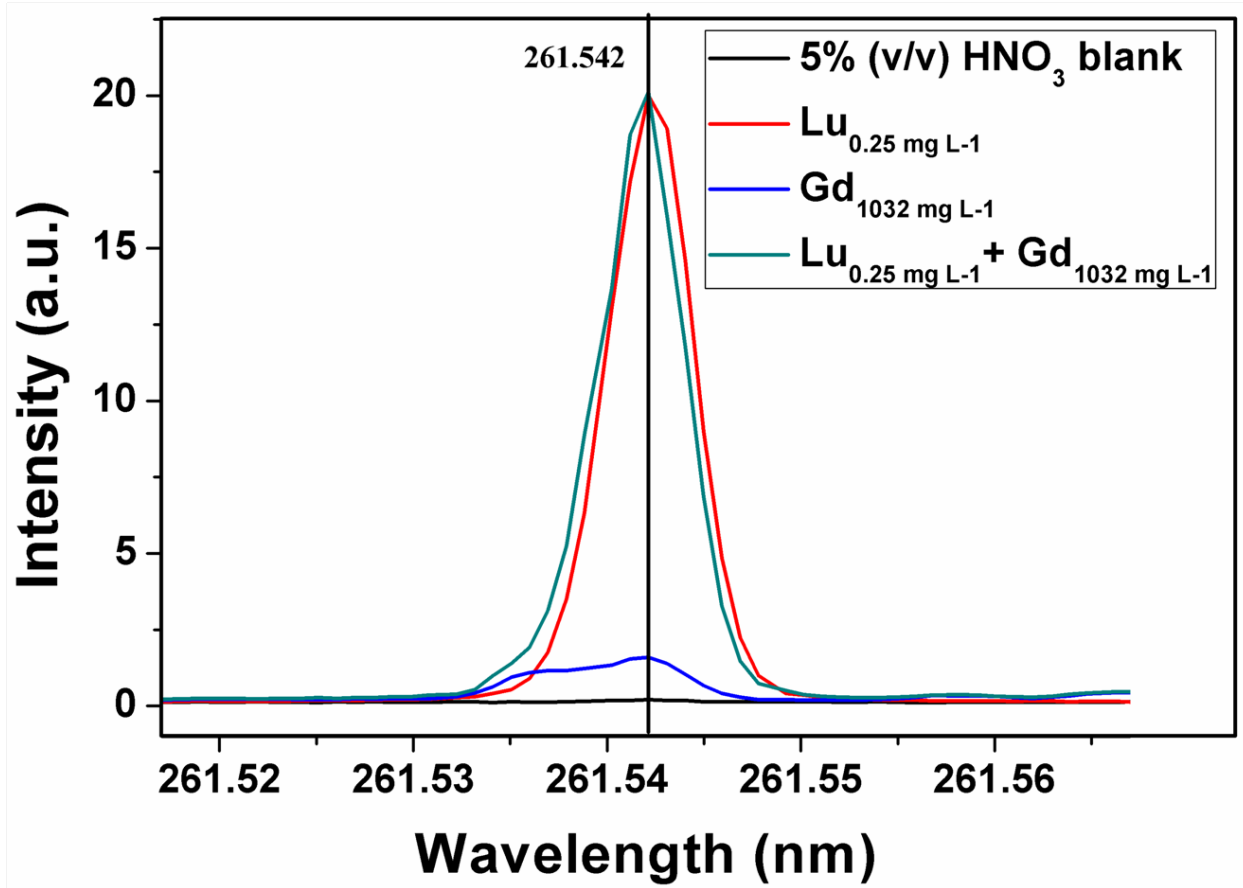


Fig. S5(m)