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Optical constants of rare-earth substituted ferrite-type amorphous garnets and nanoscale garnet-oxide layers

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Supplementary Materials:

The following data tables summarize the optical constant datasets obtained from the characterization of three important subclasses of MO garnet material compositions, as well as their oxide-diluted nanocomposite-type derivatives.

Table S1: Calculated results from the optical study of $Y_3Fe_5O_{12}$ (YIG) and $Y_3Fe_5O_{12}$:Bi_2O_3 composites

Sample	Wavelength (nm)	T_M	T_m	n_1	d_1 (nm)	m_0	M	d_2 (nm)	n_2
YIG	2106	0.9312835	0.702	2.184	-	2.9	3.0	1446	2.202
($Y_3Fe_5O_{12}$)	1804	0.9202	0.6950119	2.186	1463	3.4	3.5	1444	2.201
	1596	0.910876	0.685	2.201	1427	3.8	4.0	1450	2.225
	1414	0.885	0.6677353	2.209	1431	4.3	4.5	1440	2.218
	1284	0.8591392	0.65	2.219	1427	4.8	5.0	1447	2.238
	1164	0.82	0.6253531	2.226	1437	5.3	5.5	1438	2.232
	1078	0.7785072	0.598	2.238	1403	5.8	6.0	1445	2.255
	992	0.73	0.5660652	2.251	1443	6.3	6.5	1432	2.248
	934	0.6748371	0.53	2.263	1308	6.7	7.0	1445	2.279
	866	0.618	0.4885206	2.296	1312	7.4	7.5	1414	2.264
	826	0.5465578	0.44	2.316	1326	7.8	8.0	1427	2.303
	770	0.48	0.3939807	2.332	1337	8.4	8.5	1403	2.281
	744	0.4161285	0.347	2.364	-	-	-	-	-
d_1 (ave) = 1392 nm, δ_1 = 58.78 nm (4.22%), d_2 (ave) =1434 nm, δ_2 = 14.92 nm (1.04%),									
YIG + 10	2420	0.92	0.6913988	2.197	-	1.5	1.5	826	2.238
vol. % Bi_2O_3	1768	0.9150824	0.684	2.211	768	2.0	2.0	800	2.180
composite	1420	0.908	0.6794107	2.213	829	2.5	2.5	802	2.189
	1196	0.8809877	0.663	2.217	828	3.0	3.0	809	2.212
	1026	0.8455	0.642201	2.219	858	3.5	3.5	809	2.214
	912	0.8054296	0.618	2.222	800	4.0	4.0	821	2.249

	806	0.74	0.5729811	2.247	859	4.5	4.5	807	2.236
	746	0.6713922	0.53	2.252	728	5.0	5.0	828	2.300
	670	0.58	0.4595239	2.328	765	5.5	5.5	791	2.272
	640	0.4846828	0.395	2.350	-	-	-	-	-
d1 (ave) = 804 nm, δ1 = 47.43 nm (5.8%), d2 (ave) =810 nm, δ2 = 11.9 nm (1.4%)									
YIG + 20	2198	0.94	0.7067361	2.185	-	1.5	1.5	755	2.169
vol. % Bi_2O_3	1636	0.9359865	0.704	2.186	740	2.0	2.0	748	2.152
composite	1310	0.9345	0.7028631	2.187	769	2.5	2.5	749	2.154
	1102	0.922008	0.695	2.189	814	3.0	3.0	755	2.175
	960	0.916	0.6906391	2.192	793	3.5	3.5	766	2.210
	840	0.9007389	0.68	2.198	731	4.0	4.0	764	2.210
	750	0.88	0.6598057	2.226	792	4.5	4.5	758	2.220
	686	0.8399973	0.6364	2.228	762	5.0	5.0	770	2.256
	626	0.758	0.5786272	2.268	817	5.5	5.5	759	2.265
	592	0.6542809	0.513	2.285	-	-	-	-	-
d1 (ave) = 777 nm, δ1 = 32.19 nm (4.1%), d2 (ave) =758 nm, δ2 = 9.22 nm (1.21%)									
YIG + 30	1826	0.92787	0.69015	2.185	-	1.6	1.5	627	2.139
vol. % Bi_2O_3	1370	0.9278699	0.7	2.186	632	2.1	2.0	627	2.140
composite	1100	0.9215	0.6796238	2.187	659	2.7	2.5	629	2.148
	930	0.9210977	0.668	2.189	671	3.2	3.0	637	2.179
	802	0.9205	0.6661462	2.192	682	3.7	3.5	640	2.192
	712	0.9060236	0.655	2.198	662	4.1	4.0	648	2.224
	638	0.88	0.6283655	2.226	726	4.6	4.5	645	2.242
	590	0.8095062	0.58	2.228	659	5.1	5.0	662	2.304
	534	0.66	0.4911559	2.268	788	5.7	5.5	647	2.294
	518	0.5078051	0.398	2.285	-	-	-	-	-
d1 (ave) = 670 nm, δ1 = 28.9 nm (4.3%), d2 (ave) = 640 nm, δ2 = 16.77 nm (2.6%)									

Table S2: Calculated results from the optical study of $Bi_3Fe_5O_{12}$ (BIG) and $Bi_3Fe_5O_{12}$:Dy_2O_3 composites

Sample	**Wavelength (nm)**	**T_M**	**T_m**	**n_1**	**d_1 (nm)**	**m_0**	**M**	**d_2 (nm)**	**n_2**
BIG	2010	0.92	0.6405727	2.358	-	1.5	1.5	639	2.345
($Bi_3Fe_5O_{12}$)	1522	0.9195267	0.638	2.366	655	2.0	2.0	643	2.367
	1234	0.918	0.6299075	2.390	647	2.5	2.5	645	2.399
	1034	0.9073576	0.62	2.407	646	3.0	3.0	645	2.412
	894	0.906	0.6144619	2.423	648	3.5	3.5	646	2.433
	792	0.8985783	0.602	2.455	643	4.0	4.0	645	2.464

	714	0.879	0.5833558	2.491	631	4.5	4.5	645	2.499
	656	0.8166641	0.54	2.553	597	5.0	5.0	642	2.551
	600	0.694	0.4754089	2.595	746	5.5	5.5	636	2.566
	576	0.5298721	0.388	2.628	-	-	-	-	-
d_1 (ave) = 638 nm, δ_1 = 19.43 nm (3.04%), d_2 (ave) = 643 nm, δ_2 = 3.36 nm (0.52%),									
BIG + 11	2052	0.9190512	0.642	2.352	-	2.1	2.0	873	2.324
vol. %	1654	0.91904	0.6419135	2.352	891	2.5	2.5	879	2.341
Dy_2O_3	1380	0.9135574	0.638	2.356	873	3.1	3.0	879	2.344
composite	1190	0.91	0.6310574	2.373	883	3.6	3.5	877	2.358
	1050	0.8976417	0.6211	2.387	903	4.1	4.0	880	2.378
	938	0.89	0.6165862	2.390	921	4.6	4.5	883	2.390
	852	0.8840802	0.611	2.400	883	5.0	5.0	888	2.412
	782	0.87	0.5943409	2.435	899	5.6	5.5	883	2.435
	726	0.8363913	0.575	2.449	915	6.0	6.0	889	2.466
	674	0.77	0.5385252	2.467	923	6.6	6.5	888	2.481
	640	0.6885704	0.49	2.505	863	7.0	7.0	894	2.537
	596	0.535	0.4039928	2.527	1011	7.6	7.5	884	2.531
	582	0.4212745	0.332	2.566	-	-	-	-	-
d1 (ave) = 906 nm, δ1 = 39.71 nm (4.38%), d2 (ave) =883 nm, δ2 = 6.01 nm (0.68%)									
BIG + 15	1914	0.923	0.6535998	2.321	-	1.6	1.5	619	2.307
vol. %	1452	0.9220213	0.643	2.353	618	2.1	2.0	617	2.334
Dy_2O_3	1168	0.92	0.6398489	2.360	635	2.6	2.5	619	2.347
composite	984	0.9050367	0.63	2.369	633	3.1	3.0	623	2.372
	850	0.895	0.6192527	2.389	639	3.6	3.5	623	2.391
	758	0.8718887	0.6	2.418	649	4.1	4.0	627	2.437
	680	0.805	0.5634301	2.435	671	4.6	4.5	628	2.459
	630	0.7137245	0.508	2.479	-	-	-	-	-
d1 (ave) = 641 nm, δ1 = 17.85 nm (2.78%), d2 (ave) =622 nm, δ2 = 6.17 nm (0.99%)									
BIG + 20	1928	0.9419826	0.68	2.268	-	1.0	1.0	425	2.248
vol. %	1298	0.93	0.6702144	2.279	443	1.5	1.5	427	2.270
Dy_2O_3	996	0.9146836	0.657	2.296	434	2.0	2.0	434	2.322
composite	798	0.873	0.6281079	2.321	438	2.5	2.5	430	2.326
	694	0.8166119	0.58	2.392	-	-	-	-	-
d1 (ave) = 483 nm, δ1 = 4.475 nm (1.02%), d2 (ave) = 429 nm, δ2 = 3.8 nm (0.88%)									

Table S3: Calculated results from the optical study of $Bi_{1.8}Lu_{1.2}Fe_{3.9}Al_{1.1}O_{12}$ and $Bi_{1.8}Lu_{1.2}Fe_{3.9}Al_{1.1}O_{12}$:$Bi_2O_3$ composites

Sample	Wavelength (nm)	T_M	T_m	n_1	d_1 (nm)	m_0	M	d_2 (nm)	n_2
BiLuIG	1890	0.9385773	0.74	2.084	-	2.0	2.0	907	2.088
Sample	1526	0.9358	0.7361392	2.091	895	2.5	2.5	912	2.107
	1262	0.9307553	0.73101	2.097	893	3.0	3.0	903	2.091
	1088	0.9208	0.7237528	2.100	927	3.5	3.5	907	2.104
	958	0.9193446	0.72	2.108	910	4.0	4.0	909	2.117
	856	0.912	0.7109351	2.122	897	4.5	4.5	907	2.128
	778	0.9065951	0.7	2.146	864	5.0	5.0	906	2.149
	710	0.89	0.6822742	2.171	892	5.5	5.5	899	2.157
	660	0.8484609	0.652	2.191	886	6.0	6.0	904	2.187
	612	0.78	0.6041645	2.217	936	6.5	6.5	897	2.197
	582	0.6844691	0.54	2.243	-	-	-	-	-
d_1 (ave) = 900 nm, δ_1 = 21.59 nm (2.39%), d_2 (ave) = 905 nm, δ_2 = 4.49 nm (0.49%),									
BiLuIG + 5	1970	0.938	0.7246817	2.128	-	1.5	1.5	694	2.106
vol. % Bi_2O_3	1496	0.9359738	0.72	2.138	706	2.0	2.0	700	2.133
composite	1198	0.93	0.7150641	2.143	704	2.6	2.5	699	2.135
	1008	0.9276888	0.709	2.157	716	3.1	3.0	701	2.156
	870	0.923	0.70411653	2.163	722	3.6	3.5	704	2.170
	770	0.9222985	0.698	2.181	688	4.1	4.0	706	2.195
	688	0.9065951	0.6795029	2.210	720	4.6	4.5	700	2.207
	632	0.8677492	0.652	2.229	699	5.0	5.0	709	2.252
	576	0.78	0.5927938	2.263	770	5.6	5.5	700	2.258
	548	0.660146	0.516	2.288	-	-	-	-	-
d1 (ave) = 716 nm, δ1 = 24.82 nm (3.47%), d2 (ave) = 701 nm, δ2 = 4.30 nm (0.61%)									
BiLuIG + 12	1746	0.93	0.7095679	2.159	-	1.5	1.5	755	2.169
vol. % Bi_2O_3	1320	0.9289102	0.704	2.174	614	1.5	1.5	607	2.150
composite	1064	0.924	0.6985855	2.182	612	2.0	2.0	607	2.168
	894	0.9243653	0.692	2.203	612	2.5	2.5	610	2.184
	772	0.9201	0.6860107	2.214	633	3.0	3.0	609	2.202
	686	0.9108897	0.675	2.232	602	3.5	3.5	610	2.218
	614	0.88	0.6463755	2.271	626	3.9	4.0	615	2.253
	568	0.8106904	0.6	2.302	531	4.5	4.5	608	2.269
	514	0.65	0.4919373	2.385	606	4.9	5.0	617	2.332
	498	0.5071745	0.4	2.429	-	-	-	-	-
d1 (ave) = 604 nm, δ1 = 31.25 nm (5.17%), d2 (ave) = 609 nm, δ2 = 6.717 nm (1.1%)									

BiLuIG + 20	2082	0.95	0.7149712	2.177	-	1.5	1.5	717	2.169
vol. % Bi_2O_3	1568	0.9476974	0.7101	2.188	713	2.1	2.0	717	2.178
composite	1254	0.945	0.707353	2.191	720	2.6	2.5	715	2.177
	1054	0.9405464	0.701	2.203	725	3.1	3.0	718	2.196
	908	0.94	0.6972681	2.213	708	3.6	3.5	718	2.207
	798	0.9379544	0.69	2.232	734	4.1	4.0	715	2.217
	718	0.931	0.6837883	2.239	763	4.6	4.5	722	2.244
	656	0.916525	0.668	2.264	720	5.1	5.0	724	2.278
	600	0.88	0.641444	2.288	750	5.6	5.5	721	2.292
	562	0.8164691	0.6	2.314	742	6.1	6.0	729	2.342
	520	0.664	0.5097502	2.333	828	6.6	6.5	724	2.347
	502	0.5444138	0.431	2.370	-	-	-	-	-

d1 (ave) = 740 nm, δ1 = 35.37 nm (4.7%), d2 (ave) = 720 nm, δ2 = 4.31 nm (0.59%)