Radiation Effects Data on Commercially Available Optical Fiber: Database Summary Update 2008

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Radiation Database Survey 2001-2008: *Executive Summary*

- **The following data represents a continuing research effort to maintain a clear and comprehensive tool for the radiation effects community. More specifically, those groups developing fiber optic technology operating in radiation sensitive environments.**
- **Recently, the need arose to revisit and update the original database summary work by M. Ott [1] due in part to the severe decline of the telecom industry and the present state of the technology sector as whole.**
- **Since this decline many companies, in particular fiber optic companies, have been bought, sold, or no longer in operation. Often during these situations manufacturing methods and procedures change. For example, a product manufactured under one company may have performed above expectations several years ago and due to a "buy-out" or "restructuring" action (i.e. Lay-offs) may not perform adequate today and vice a versa. For this reason it is imperative that a watchful eye be dedicated to industry changes and technology trends not only to update this database, but discover new and better performing technologies for future missions.**

1. ***M. Ott "Radiation Effects Data on Commercially Available Optical Fiber: Database Summary," Nuclear Science and Radiation Effects Conference, Phoenix, Arizona, NSREC 2002, Data Workshop Proceedings, July, pp.24-31.***

COTS Fiber Descriptions

MULTIMODE FIBER RAD DESCRIPTIONS

Fiber ID	Manufacturer	Part Number	Fiber Description	[Ref#] paper ID
MM-020201	WL Gore (OFS Fitel)	FOA 8100/1/12/1	100/140/250; 5.24m Length	[3] 2002-02
MM-020603	Polymicro	FVP200220240	Step 0.22na Polyimide; 200/220240; <10m	[4] 2002-06
MM-020604	Polymicro	FVP100110125	Step 0.22na Polyimide; 100/110/125; <10m	[4] 2002-06
MM-020801	Heraeus	SWU 1.2 087/200	Step Index; 0.22na; Low OH High Cl; CCDR 1.2; 223m Length	[5] 2002-08
MM-021001	FORC (Moscow)	KS-4V	Step Index w/F_Doped Clad; 110/125/280; 40m & 70m	[6] 2002-10
MM-021002	Heraeus	SSU 1.2 107/00	Step Index; 104/125/250; 0.22na; High OH Low Cl; CCDR 1.2; 40m & 70m	[6] 2002-10
MM-021003	Heraeus	STU 1.2 237/2000	Step Index; 104/125/250; 0.22na; High OH Low Cl; CCDR 1.2; 40m & 70m	[6] 2002-10
MM-021004	Mitsubishi Rayon	STR100C-SY	Step Index; 100/150/300; Low OH; 40m & 70m	[6] 2002-10
MM-022201	FORC (Moscow)	KS-4V	Pure Silica OH&Cl free; Hydrogen treated; 200/250; 20m Length	[8] 2002-22
MM-022202	FORC (Moscow)	KU-1	Pure Silica OH&Cl free; Hydrogen treated; 200/250; 20m Length	[8] 2002-22
MM-022203	FORC (Moscow)	KU-H2G	Pure Silica OH&Cl free; Hydrogen treated; 200/250; 20m Length	[8] 2002-22
MM-022204	Fujikura Ltd.	FF Fiber	F-doped OH free; 200/250; 20m Length	[8] 2002-22
MM-022205	Mitsubishi	MF Fiber	F-doped OH free; 200/250; 20m Length	[8] 2002-22
MM-022304	FORC (Moscow)	SPPF 97-10-20	P-doped; MCVD Process; 28/120/250	[9] 2002-23
MM-030201	FORC (Moscow)	KU-1	High OH; Low Cl and F-doped; 200/240/325;	[10] 2003-02
MM-031101	Polymicro	FVP300330370	300/330/370; 0.7m - 1.68m Length;	[11] 2003-11
MM-031102	Polymicro	FIP300330370	300/330/370; 1.68m - 2.06m Length;	[11] 2003-11
MM-041201	Fujikura Ltd.	G-series MM Fiber	200/250; Graded Index; 0.21na; Pure silica; 10m Length	[13] 2004-12
MM-051201	OFS	F14369	MM; Graded; Polyimide; Hermetic; 0.20na; 20m Length	[14] 2005-12
MM-051202	Corning	InfiniCor Fiber 50/125	0.20na; Graded-Index; Acrylate; 20m Length	[14] 2005-12
MM-060204	Nufern	GR50/125-23-HTA	50/125; Graded-Index; <10m Length; Rad-Hardened	[15] 2006-02
MM-060205	Nufern	GR62.5/125-27-HTA	62.5/125; Graded-Index; <10m Length; Rad-Hardened	[15] 2006-02
MM-060206	Nufern	GR100/140-24-HTA	100/140; Graded-Index; <10m Length; Rad-Hardened	[15] 2006-02
MM-060207	OFS	BF04431	62.5/125; Graded-Index; <10m Length; Rad-Hardened	[15] 2006-02
MM-060208	OFS	BF05444	100/140; Graded-Index; <10m Length; Rad-Hardened	[15] 2006-02
MM-071101	ThorLabs	BFL37-200	200/230; Low OH; 50m Length	[17] 2007-11
MM-071102	ThorLabs	BFH37-200	200/230; High OH; 50m Length	[17] 2007-11
MM-071401	Polymicro	FSHA-800	600/660/800; High OH; 0.22na; 5m Length	[18] 2007-14

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SINGLEMODE FIBER DESCRIPTIONS

Fiber ID	Manufacturer	Part Number	Fiber Description	[Ref#] paper ID
SM-020601	Spectran	SMC-A0515B	3/125/245; SM UV 0.11na Acrylate; Delay Line 2km	[4] 2002-06
SM-020602	Spectran	SMC-A0980B	6.2/125/245; SM UV 0.11na Acrylate; Delay Line 2km	[4] 2002-06
SM-022301	Corning	SMF-28	Ge-Doped; 9/125/250	[9] 2002-23
SM-022302	Lucent	AllWave	Ge-Doped; 9/125/250	[9] 2002-23
SM-022303	FORC (Moscow)	SR-00-12-28	P-doped; MCVD Process; 4/125/250	[9] 2002-23
SM-041101	Sumitumo	Z-Fiber	5km Coil; Pure Silica fiber	[12] 2004-11
SM-041102	Corning	SMF-28	5km Coil; Ge-Doped; 9/125/250	[12] 2004-11
SM-060201	Nufern	S1550-HTA	9/125/250	[15] 2006-02
SM-060202	Nufern	R1310-HTA	9/125/250	[15] 2006-02
SM-060203	Corning	SMF-28	9/125/250	[15] 2006-02

MISC FIBER DESCRIPTIONS

Fiber ID	Manufacturer	Part Number	Fiber Description	[Ref#] paper ID
PS-010301	Mitsubishi Rayon	SH8001	POF Core w/PMMA Clad; 2mm total dia; Step Index	[1] 2001-03
ER-010401	Lucent	HE980 (amp)	Er Doped Fiber; 3m Length; Simple Multi-Layer 62.5um Core/Clad	[2] 2001-04
ER-010402	Lucent	HP980 (amp)	Er Doped Fiber; 3m Length; Simple Multi-Layer 62.5um Core/Clad	[2] 2001-04
ER-010403	Lucent	MP980 (amp)	Er Doped Fiber; 3m Length; Simple Multi-Layer 62.5um Core/Clad	[2] 2001-04
ER-010404	Lucent	LP980 (amp)	Er Doped Fiber; 3m Length; Simple Multi-Layer 62.5um Core/Clad	[2] 2001-04
ER-010405	Lucent	HG980 (src)	Er Doped Fiber; 3m Length; Simple Multi-Layer 62.5um Core/Clad	[2] 2001-04
ER-022001	AT&T	HE980	Er Doped Fiber; 10m Length	[7] 2002-20
PM-041103	Corning	PRSM	80um Fiber DIA; approx 3m; PM Fiber	[12] 2004-11
PM-041104	3M	Rad-Hard PM Fiber	80um Fiber DIA; approx 3m; PM Fiber	[12] 2004-11
PM-060209	Nufern	PM1550G-80	80um Fiber DIA; approx 3m; PM Fiber	[12] 2004-11
PM-060210	Nufern	PM850G-80	80um Fiber DIA; approx 3m; PM Fiber	[12] 2004-11
PM-060211	3M	FS-PM-7621	80um Fiber DIA; approx 3m; PM Fiber	[12] 2004-11
PM-060212	3M	FS-PM4611	80um Fiber DIA; approx 3m; PM Fiber	[12] 2004-11
PM-060213	FiberCore	HB800	80um Fiber DIA; approx 3m; PM Fiber	[12] 2004-11
PM-070101	Lieki	Yb1200-10/125DC	Yb-doped; Double Clad; 3m Length; 10/125	[16] 2007-01
PM-070102	Lieki	Yb1200-20/400DC	Yb-doped; Double Clad; 3m Length; 20/400	[16] 2007-01
PM-070103	Lieki	Yb1200-30/250DC	Yb-doped; Double Clad; 3m Length; 30/250	[16] 2007-01
PM-070104	Lieki	Yb1200-4/125	Yb-doped; 3m Length; 4/125	[16] 2007-01
PM-070105	Lieki	Yb2000-6/125DC	Yb-doped; Double Clad; 3m Length; 6/125	[16] 2007-01

COTS Fiber Radiation Effects

MULTIMODE FIBER RAD EFFECTS

Fiber ID	λ(nm)	Dose Rate	Total Dose	Temp	Attenuation	Details	[Ref#] paper ID
MM-020603	1064; 532	Gamma 0.038 rads/min	Gamma 30 krads	25°C	0.16 dB/km	Estimated	[3] 2002-02
MM-020604	1064; 532	Gamma 0.038 rads/min	Gamma 30 krads	25°C	0.16 dB/km	Estimated	[4] 2002-06
MM-020801	829; 1310	Gamma 27 rads/s	Gamma 1k, 10k, 50k rads	25°C	*Data inconclusive*	N/A	[4] 2002-06
MM-021001	1310	Gamma 18 rads/s	Gamma 1 Mrad	25°C	Approx 14 dB/km	Graph Data	[5] 2002-08
MM-021002	829	Gamma 18 rads/s	Gamma 1 Mrad	25°C	Approx 23.5 dB/km	Graph Data	[6] 2002-10
MM-021003	1310	Gamma 18 rads/s	Gamma 1 Mrad	25°C	Approx 5 dB/km	Graph Data	[6] 2002-10
MM-021004	1310	Gamma 18 rads/s	Gamma 1 Mrad	25°C	Approx 76 dB/km	Graph Data	[6] 2002-10
MM-022001	1530	Gamma 1.3k rads/min	Gamma 1 Mrad	25°C	Approx 10 dB/meter	Estimated	[6] 2002-10
MM-022201	600-650	Gamma 330 rads/s	Gamma $19x10^6$ rad	25°C	0.8 dB/meter	Actual Data	[8] 2002-22
MM-022202	600-650	Gamma 330 rads/s	Gamma $19x10^6$ rad	25°C	2.5 dB/meter	Actual Data	[8] 2002-22
MM-022203	600-650	Gamma 330 rads/s	Gamma $19x10^6$ rad	25°C	0.8 dB/meter	Actual Data	[8] 2002-22
MM-022204	600-650	Gamma 330 rads/s	Gamma $19x10^6$ rad	25°C	0.9 dB/meter	Actual Data	[8] 2002-22
MM-022205	600-650	Gamma 330 rads/s	Gamma $19x10^6$ rad	25°C	0.25 dB/meter	Actual Data	[8] 2002-22
MM-022304	1550	Gamma 100 -1k rads/hr	Gamma ≤ 1 Mrad	25°C - +60c	*Data inconclusive*	N/A	[9] 2002-23
MM-030201	Broadband	Gamma 540 rads/s	Gamma 580 Mrads	130c	Approx Vis 3.2 dB/meter	Graph Data	[10] 2003-02
MM-031101	380-630	Gamma 80 rads/s	Gamma 100 Mrad	25°C	10dB/m @ 380nm; 1.5-3.0dB @ 430-450nm; ≤ 5.5dB/m @ 630nm	Actual Data	[11] 2003-11
MM-031102	380-630	Gamma 80 rads/s	Gamma 100 Mrad	25°C	10dB/m @ 380nm; 1.5-3.0dB @ 430-450nm; ≤ 5.5dB/m @ 630nm	Actual Data	[11] 2003-11
MM-041201	630-1390	Gamma 720k rads/hr	Gamma 14.4M rad	25°C	Approx 10.25dB/m @ 630nm; 3.75dB/m @ 1390	Graph Data	[13] 2004-12
MM-051201	1064	Gamma 760k rads/hr	Gamma 30M rad	45°C	0.35dB/m	Actual Data	[14] 2005-12
MM-051202	1064	Gamma 760k rads/hr	Gamma 30M rad	45°C	0.38dB/m	Actual Data	[14] 2005-12
MM-060204	850; 1300	Gamma 2 rads/s	Gamma 30k rads	25°C	Approx 81dB/km @ 850nm; 3.7dB/km @ 1300nm	Actual Data	[15] 2006-02
MM-060205	850; 1300	Gamma 2 rads/s	Gamma 30; 50k rads	25°C	Approx 81dB/km @ 850nm; 4.1dB/km @1300nm	Actual Data	[15] 2006-02
MM-060206	850; 1300	Gamma 2 rads/s	Gamma 40; 50k rads	25°C	Approx 82dB/km @ 850nm; 4.4dB/km @1300nm	Actual Data	[15] 2006-02

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MM-060207	1300	Gamma 2 rads/s	Gamma 50k rads	25°C	583dB/m	Actual Data	[15] 2006-02
MM-060208	1300	Gamma 2 rads/s	Gamma 50k rads	25°C	21dB/m	Actual Data	[15] 2006-02
MM-071101	633	Gamma 0.5 rads/s	Gamma 10k rads	25°C	<0.5dB/m	Graph Data	[17] 2007-11
MM-071102	633	Gamma 0.5 rads/s	Gamma 20k rads	25°C	<0.5dB/m	Graph Data	[17] 2007-11
MM-071401	620	NA	Gamma 500k rads	25°C	<1.0dB/m	Graph Data	[18] 2007-14

SINGLEMODE FIBER RAD EFFECTS

Fiber ID	λ(nm)	Dose Rate	Total Dose	Temp	Attenuation	Details	[Ref#] paper ID
SM-020601	1064; 532	Gamma 0.038 rads/min	Gamma 30k rads	25°C	0.16 dB/km	Estimated	[4] 2002-06
SM-020602	1064; 532	Gamma 0.038 rads/min	Gamma 30k rads	25°C	0.16 dB/km	Estimated	[4] 2002-06
SM-022301	1550	Gamma 6k rads/hr	Gamma ≤ 10M rad	25°C - +85c	Approx 15 - 20 dB/km	Graph Data	[9] 2002-23
SM-022302	1550	Gamma 6k rads/hr	Gamma ≤ 10M rad	25°C - +85c	Approx 10 - 27 dB/km	Graph Data	[9] 2002-23
SM-022303	1550	Gamma 100 -1k rads/hr	Gamma ≤ 10M rad	25°C - +60c	*Data inconclusive*	N/A	[9] 2002-23
SM-041101	1510	Gamma 0.6 rads/s	Gamma 1M rad	50°C	4.5dB/km	Extrapolated	[12] 2004-11
SM-041102	1530	Gamma 0.6 rads/s	Gamma 1M rad	50°C	1.3dB/km	Extrapolated	[12] 2004-11
SM-060201	1550	Gamma 2 rads/s	Gamma 50k rads	25°C	Approx 1.0dB/km	Graph Data	[15] 2006-02
SM-060202	1550	Gamma 2 rads/s	Gamma 50k rads	25°C	Approx 3.2dB/km	Graph Data	[15] 2006-02
SM-060203	1550	Gamma 2 rads/s	Gamma 50k rads	25°C	Approx 6.5dB/km	Graph Data	[15] 2006-02

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MISC FIBER RAD EFFECTS

Fiber ID	λ(nm)	Dose Rate	Total Dose	Temp	Attenuation	Details	[Ref#] paper ID
ER-010401	980; 1300; 1550	Gamma 1.4 rads/s	Gamma 50k rads	25°C	0.65 dB/m @ 980nm; 0.21 dB/m @ 1300nm; 0.013dB @ 1550nm	Actual Data	[2] 2001-04
ER-010402	980; 1300; 1550	Gamma 1.4 rads/s	Gamma 50k rads	25°C	3.5 dB/m @ 980nm; 1.0 dB/m @ 1300nm; 0.60dB @ 1550nm	Actual Data	[2] 2001-04
ER-010403	980; 1300; 1550	Gamma 1.4 rads/s	Gamma 50k rads	25°C	1.65 dB/m @ 980nm; 0.50 dB/m @ 1300nm; 0.345dB @ 1550nm	Actual Data	[2] 2001-04
ER-010404	980; 1300; 1550	Gamma 1.4 rads/s	Gamma 50k rads	25°C	0.240dB/m @ 980nm; NA @ 1300nm; NA @ 1550nm	Actual Data	[2] 2001-04
ER-010405	980; 1300; 1550	Gamma 1.4 rads/s	Gamma 50k rads	25°C	0.60dB/m @ 980nm; 0.19dB/m @ 1300nm; NA @ 1550nm	Actual Data	[2] 2001-04
ER-022001	1300	Gamma 4 & 27rads/min	Gamma 62 & 403k rads	25°C	2.89 dB/m (TID = 403k rads)	Actual Data	[7] 2002-20
PM-041103	1300	Gamma 0.6 rads/s	Gamma 1M rad	50°C	7.2dB/km	Extrapolated	[12] 2004-11
PM-041104	1300	Gamma 0.6 rads/s	Gamma 1M rad	50°C	4.3dB/km	Extrapolated	[12] 2004-11
PM-060209	1550	Gamma 2 rads/s	Gamma 50k rads	25°C	6.2dB/km	Actual Data	[12] 2004-11
PM-060210	1550	Gamma 2 rads/s	Gamma 50k rads	25°C	55dB/km	Actual Data	[12] 2004-11
PM-060211	1550	Gamma 175 rads/s	Gamma 5M rads	25°C	151dB/km	Actual Data	[12] 2004-11
PM-060212	820	Gamma 0.2 rads/s	Gamma 200k rads	25°C	170dB/km	Actual Data	[12] 2004-11
PM-060213	850	Gamma 21.2 rads/s	Gamma 10k rads	25°C	45.6dB/km	Actual Data	[12] 2004-11
YB-070101	Xeon	Gamma 40 rads/s	Gamma 5k rads	25°C	<10% overall att	Actual Data	[16] 2007-01
YB-070102	Xeon	Gamma 40 rads/s	Gamma 5k rads	25°C	<10% overall att	Actual Data	[16] 2007-01
YB-070103	Xeon	Gamma 40 rads/s	Gamma 5k rads	25°C	<10% overall att	Actual Data	[16] 2007-01
YB-070104	Xeon	Gamma 40 rads/s	Gamma 5k rads	25°C	<10% overall att	Actual Data	[16] 2007-01
YB-070105	Xeon	Gamma 40 rads/s	Gamma 5k rads	25°C	<10% overall att	Actual Data	[16] 2007-01

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