Evolution of TRi-structural ISOtropic (TRISO) Fuel Material Properties Under Simulated Repository Irradiation Conditions

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Table S1: SRIM calculation output for Au ion implantation.

Layer	Energy, MeV	Vacancies/ion	Ion range, Å	Straggling, Å	Dose, ions/cm²	Damage, DPA
SiC	10	28 087	15 520	1850	1.3×10^{14}	0.44
	6	20 823	8 973	1396	5.0×10^{13}	0.21
	2	10 535	3 068	521	4.0×10^{13}	0.24
	0.08	891	283	56	5.0×10^{13}	0.27
PyC	10	20 987	25 040	2135	1.3×10^{14}	0.12
	6	15 702	14 550	1482	5.0×10^{13}	0.06
	2	8 094	4 909	666	4.0×10^{13}	0.07
	0.08	825	457	62	5.0×10^{13}	0.09

Table S2: SRIM calculation output for He ion implantation.

	Energy, MeV	Vacancies/ion	Ion range, Å	Straggling, Å	Dose, ions/cm²	Damage, DPA
SiC	0.6	95	23 220	952	1.0×10^{16}	0.05
	0.5	93	20 120	998	6.2×10^{15}	0.03
	0.4	91	17 070	964	6.1×10^{15}	0.04
	0.3	87	13 940	885	6.0×10^{15}	0.04
	0.2	85	10 500	848	6.3×10^{15}	0.06
	0.1	78	6 422	759	5.8×10^{15}	0.07
	0.05	67	3 894	611	4.6×10^{15}	0.08
PyC	0.6	108	14 880	919	1.0×10^{16}	0.14
	0.5	105	12 970	902	6.2×10^{15}	0.10
	0.4	105	10 970	923	6.1×10^{15}	0.11
	0.3	99	9 016	856	6.0×10^{15}	0.13
	0.2	95	6 840	830	6.3×10^{15}	0.16
	0.1	86	4 319	710	5.8×10^{15}	0.21
	0.05	75	2 645	581	4.6×10^{15}	0.22

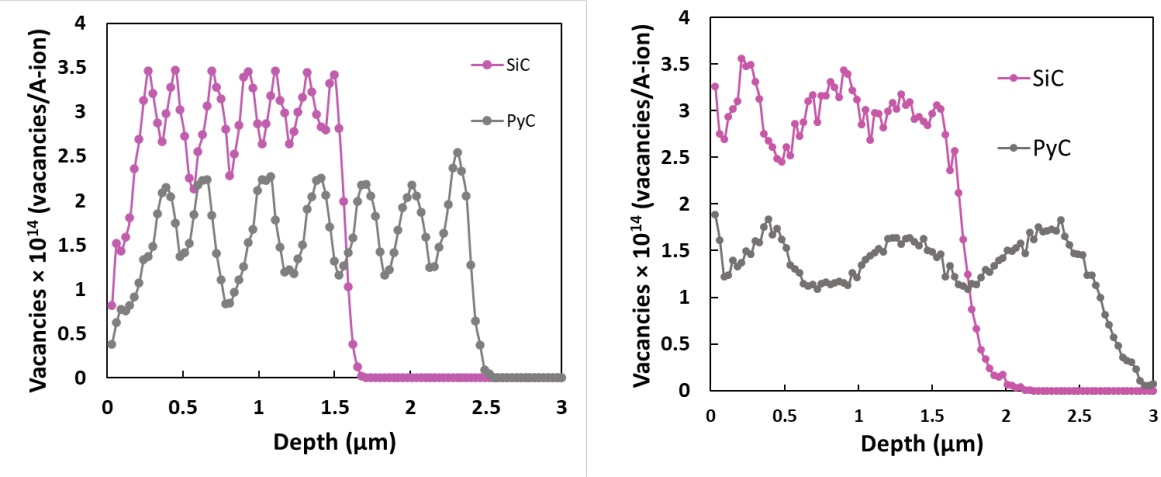

Figure S1: Vacancy profile (number of vacancies per unit depth per incident ion) obtained from SRIM simulation for Au and He implantation.

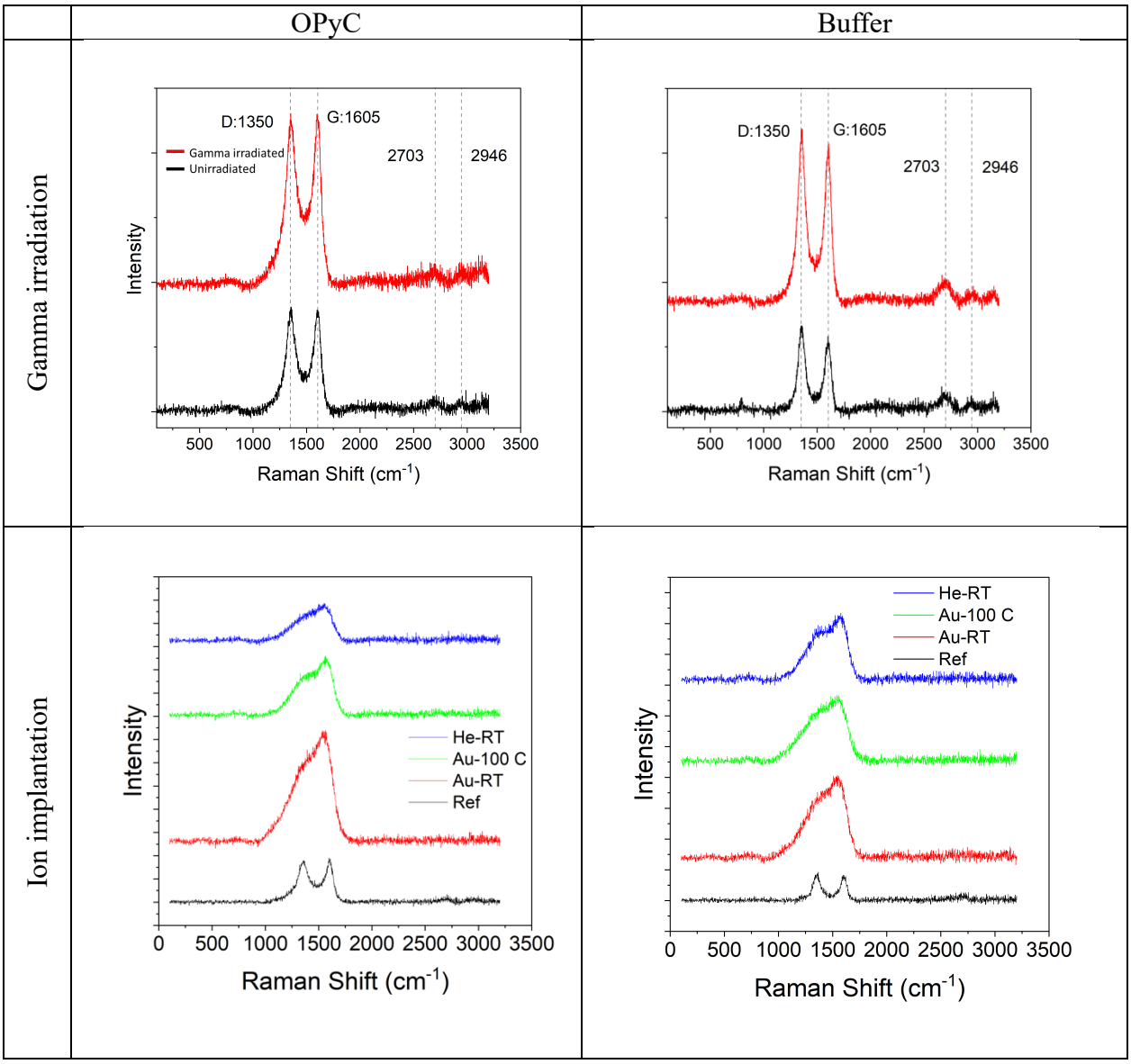

Figure S2: Comparing Raman spectra of OPyC and buffer layers in different samples.

Table S3: Extracted parameters from nanoindentation measurements.

	Hardness (Gpa)		hmax (nm)		Stiffness (mN/nm)		hf (nm)		Elastic modulus (Es) (GPa)	
	SiC	**IPyC**	**SiC**	**IPyC**	**SiC**	**IPyC**	**SiC**	**IPyC**	**SiC**	**IPyC**
Ref	30.66 ± 0.06	2.22 ± 0.08	803 ± 16	1529± 14	0.12 ± 0.00	0.07 ± 0.00	225 ± 17	57 ± 39	332 ± 17	11.0 ± 0.1
He-RT	34.00 ± 0.05	3.60 ± 0.10	597 ± 8	1164 ± 6	0.15 ± 0.00	0.09 ± 0.00	129 ± 12	254 ± 19	478 ± 6	19.7 ± 0.4
Gamma	21.60 ± 0.03	1.66 ± 0.03	1034 ± 47	1721 ± 18	0.11 ± 0.00	0.06 ± 0.00	225 ± 17	18 ± 25	233 ± 7	8.9 ± 0.2
Au-RT	17.98 ± 0.01	2.40 ± 0.20	909 ± 21	1383± 37	0.13 ± 0.00	0.08 ± 0.00	117 ± 45	324 ± 20	257 ± 9	14.3 ± 0.7
Au-100 ° C	40.97 ± 0.06	3.02 ± 0.04	909 ± 21	1236 ± 13	0.15 ± 0.01	0.09 ± 0.00	175 ± 4	258 ± 26	522 ± 35	17.8 ± 0.5