

Supplementary materials

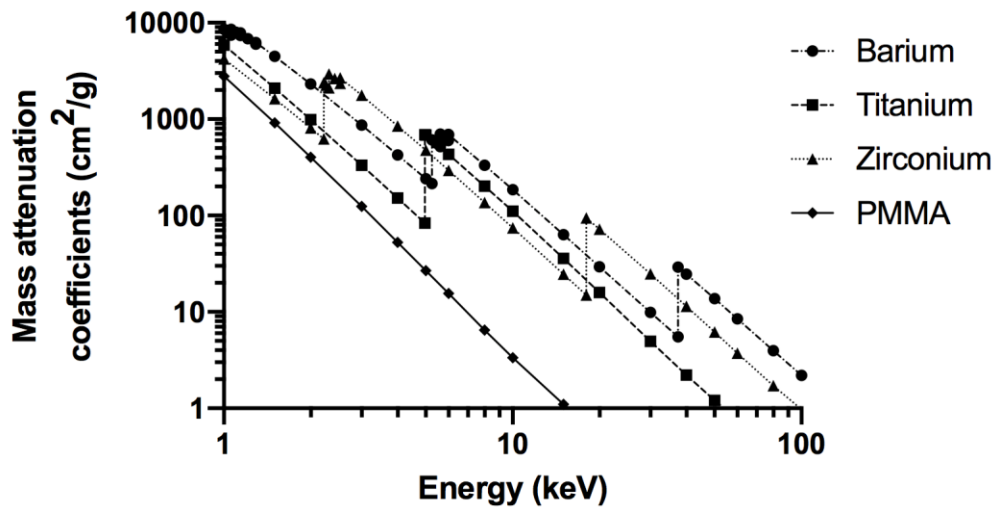


Fig. S1 Mass attenuation coefficients spectra for barium, titanium, zirconium and PMMA

Table S1 Average compressive strength, bending strength, bending modulus and fracture toughness values for tested cement compositions with standard deviations.

Sample	Compressive strength (MPa)	Bending strength (MPa)	Bending Modulus (MPa)	Critical stress intensity factor (MPam <sup>1/2</sup> )
10%w/w BaSO <sub>4</sub>	95.5 ± 2.7	53.8 ± 7.0	3725.5 ± 318.7	1.5 ± 0.3
0%w/w radiopacifier	83.7 ± 2.4 <sup>+++</sup>	66.8 ± 3.6	2991.5 ± 86.5	1.9 ± 0.2
5%w/w TiO <sub>2</sub>	80.6 ± 1.0 <sup>+++</sup>	48.1 ± 4.3 <sup>**</sup>	2906.2 ± 78.5	1.7 ± 0.2
10%w/w TiO <sub>2</sub>	86.4 ± 1.9 <sup>+++</sup>	48.1 ± 4.3 <sup>***</sup>	3637.2 ± 77.8	1.6 ± 0.2
15%w/w TiO <sub>2</sub>	80.5 ± 3.1 <sup>+++</sup>	37.3 ± 5.2 <sup>+/***</sup>	3559.9 ± 72.8	1.5 ± 0.1
20%w/w TiO <sub>2</sub>	91.5 ± 2.3 <sup>**</sup>	37.0 ± 4.0 <sup>+/***</sup>	3727.5 ± 156.3	1.4 ± 0.2
25% w/w TiO <sub>2</sub>	85.6 ± 3.6 <sup>+++</sup>	33.0 ± 4.1 <sup>+/***</sup>	3894.5 ± 166.7 <sup>**</sup>	1.3 ± 0.2 <sup>*</sup>
5%w/w ZrO <sub>2</sub>	85.3 ± 0.8 <sup>+++</sup>	41.7 ± 5.2	2993.0 ± 137.3	1.6 ± 0.2
10%w/w ZrO <sub>2</sub>	89.3 ± 2.0	41.7 ± 5.2 <sup>***</sup>	3256.3 ± 167.4	1.7 ± 0.2
15%w/w ZrO <sub>2</sub>	86.7 ± 3.4 <sup>+++</sup>	44.2 ± 4.6 <sup>***</sup>	3341.5 ± 158.4	1.6 ± 0.2
20%w/w ZrO <sub>2</sub>	88.2 ± 1.4 <sup>++</sup>	47.7 ± 2.9 <sup>***</sup>	3343.8 ± 116.9	1.6 ± 0.2
25% w/w ZrO <sub>2</sub>	88.8 ± 1.6 <sup>+</sup>	42.2 ± 8.0 <sup>***</sup>	3471.8 ± 200.8	1.3 ± 0.3
10%w/w Silane TiO <sub>2</sub>	106.0 ± 3.0 <sup>+++/***/†††</sup>	42.2 ± 8.0 <sup>*</sup>	4338.0 ± 274.8 <sup>***</sup>	1.7 ± 0.2
10%w/w Silane ZrO <sub>2</sub>	96.5 ± 1.6 <sup>***/†</sup>	53.2 ± 1.6 <sup>***</sup>	3181.8 ± 91.2	1.4 ± 0.2
Cemex	85.2 ± 4.2 <sup>+++</sup>	69.8 ± 7.8 <sup>***</sup>	3082.8 ± 204.6	1.2 ± 0.1 <sup>**</sup>
Palacos R	104.6 ± 2.9 <sup>+++/***</sup>	46.0 ± 6.5 <sup>++</sup>	3414.0 ± 123.2	2.5 ± 0.2

(++ p<0.05, +++ p<0.001 compared to 10% BaSO<sub>4</sub>; \* p<0.05, \*\* p<0.01, \*\*\*p<0.001 compared 0%w/w radiopacifier; † p<0.05, ††† p<0.001 compared to 10%w/w radiopacifier)

**Table S2** Average MC3T3 cell attachment and viability results with standard deviations for tested cement compositions.

Sample	Attached cell density (cells/cm <sup>2</sup> )			Absorbance (OD at 490nm)	
	1 hour	4 hours	24 hours	3 days	7 days
10%w/w BaSO <sub>4</sub>	4125 ± 44	5550 ± 1060	5150 ± 1031	0.082 ± 0.018	0.349 ± 0.01
0%w/w radiopacifier	4100 ± 495	4850 ± 1106	4025 ± 1187	0.079 ± 0.025	0.325 ± 0.014
10%w/w TiO <sub>2</sub>	4875 ± 287	5825 ± 409	7050 ± 727*	0.057 ± 0.028	0.334 ± 0.037
10%w/w ZrO <sub>2</sub>	3625 ± 1130	5250 ± 856	5825 ± 1228	0.027 ± 0.022	0.296 ± 0.021
10%w/w Silane TiO <sub>2</sub>	6700 ± 732 <sup>++/**/†</sup>	7725 ± 1604*	7625 ± 1064**	0.06 ± 0.027	0.31 ± 0.019
10%w/w Silane ZrO <sub>2</sub>	4225 ± 767	5625 ± 750	6200 ± 729	0.003 ± 0.006 <sup>+/*</sup>	0.202 ± 0.039 <sup>++/**/†</sup>

(+ p<0.05, ++ p<0.01, +++ p<0.001 compared to 10% BaSO<sub>4</sub>; \* p<0.05, \*\* p<0.01 compared 0%w/w radiopacifier; † p<0.05 compared to 10%w/w radiopacifier)

**Table S3** Transmitted intensity values at 35 and 70keV

Material	Original Intensity, I <sub>0</sub> (keV)	Density, ρ (g cm <sup>-1</sup> )	Mass attenuation coefficient, μ/ρ (cm <sup>2</sup> /g)	Linear attenuation coefficient, μ (cm <sup>-1</sup> )	Material thickness, e (cm)	Transmitted Intensity, I (keV)
Barium	70	3.5	5.1	17.9	1	1.3 x 10 <sup>-06</sup>
	35		6.9	24.4		9.2 x 10 <sup>-10</sup>
Titanium	70	4.5	0.5	2.3	1	7.9
	35		3.6	16.2		3.3x10 <sup>-06</sup>
Zirconium	70	6.5	2.2	14.5	1	3.6x10 <sup>-05</sup>
	35		18.1	118.0		2.0x10 <sup>-50</sup>
PMMA	70	1.18	0.2	0.2	1	60.7
	35		0.3	0.3		25.5