Electronic Supplementary Material (ESI) for Nanoscale.

Supplementary information

The relationship between cell adhesion force activation on nano/micro-topographical surfaces and temporal dependence of cell morphology

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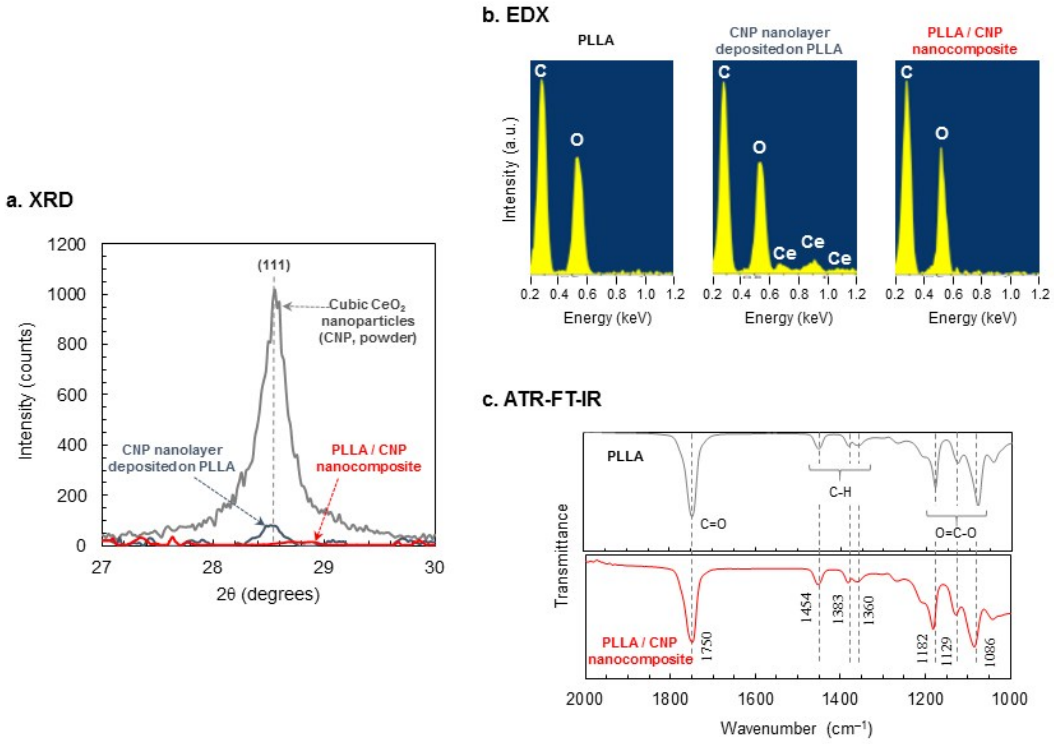

Fig. S1 The physical and chemical characteristics of a cerium oxide nanoparticle-dispersed PLLA matrix nanocomposite surface: (a) X-ray diffraction spectra of cerium oxide nanoparticles (CNP), CNP nanolayer deposited on PLLA substrate[1-3] and PLLA/CNP nanocomposite, measured by X-ray diffraction analysis (RINT 2500, Rigaku Corporation, JAPAN); (b) element spectra of PLLA matrix, CNP nanolayer deposited on PLLA substrate[1-3] and PLLA/CNP nanocomposite, detected by Field Emission Scanning Electron Microscopes (FE-SEM, S-4800, Hitachi High-Technologies Corporation, JAPAN) combined with Energy Dispersive X-ray spectrometry (EDX, E-MAX Evolution, Horiba Ltd., JAPAN); and (c) chemical bond spectra of PLLA matrix and PLLA/CNP nanocomposite, detected by Attenuated Total Reflection–Fourier Transform Infrared spectrometer (ATR-FTIR, Nicolet 4700, Thermo Fisher Scientific K.K. JAPAN). This data confirms that the top surface of PLLA/CNP nanocomposite can be used as a nano-rough PLLA surface.

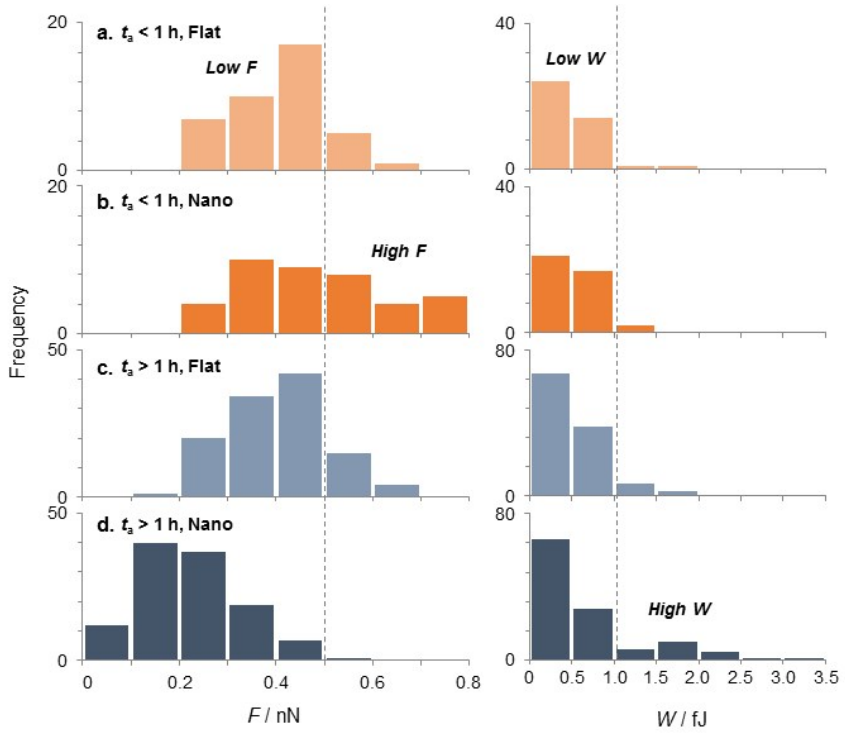

Fig. S2 Histogram of cell detachment force and work on flat and nano-topographical surfaces at cell adhesion time after initial attachment on the cantilever, t_a < 1 h and t_a > 1 h.

Table S1 Detailed measurement conditions of cell detachment force properties on substrates in each figure.

		Measured cell detachment force(F) and/or work (W) on α / α	Time periods	t_s on β	β	Functionalization on cantilever	t_d *	Force activation on topography	Fig.
Scope 1	Nano-rough	Nano / Flat	Initial	< 1 h	TL-cantilever	Con A	1 s	○	5c
		Nano / Flat	Intermediate	> 1 h	TL-cantilever	Con A	1 s	×	5d
	Micro-Dot	Dot 5	Initial	< 1 h	TL-cantilever	Con A	1 s	×	6b
		Dot 5	Initial/Intermediate	~ 1 h	TL-cantilever	Con A	10 s	×/○	6c
		Dot 40 / Flat	Intermediate	> 1 h	TL-cantilever	Con A	10 s	○	6d, 6e
	Micro-Line	Line 5	Initial	< 1 h	TL-cantilever	Con A	1 s	○	7a
		Line 5 / Flat	Initial	< 1 h	TL-cantilever	Con A	10 s	○	7a
		Line 5 / Line 40	Intermediate	> 1 h	TL-cantilever	Con A	10 s	○	7b, 7c
Scope 2	Micro-Line	Line 5	Initial	> 1 h	TL-cantilever	Con A	10 s	○	7a
		Line 5	Intermediate	2 ~ 12 h	TL-cantilever	Con A	10 and 60 s	○	8
		Line 5	Long-term***	> 24 h	Line 5	FN	180 s**	○	9

** Duration time of a cell (immobilized on TL-cantilever) on α-substrate*

*** Duration time of a cantilever (NSC12, type C) on cell surface, necessary to capture a cell from α-substrate*

**** To evaluate cell adhesion force in long-term periods, a cell-capture method, in which a cantilever directly captures a cell attached on α-substrate, is used.*

Reference

1. T. Naganuma and E. Traversa, *Biomaterials*, 2012, **4**, 4950-4953.
2. T. Naganuma and E. Traversa, *Biomaterials*, 2014, **35**, 4441–4453.
3. T. Naganuma and E. Traversa, *Nanoscale*, 2014, **6**, 6637-6645.