Enhancement of physicochemical properties of polyurethane-perovskite nanocomposite *via* addition of nickel titanate nanoparticles

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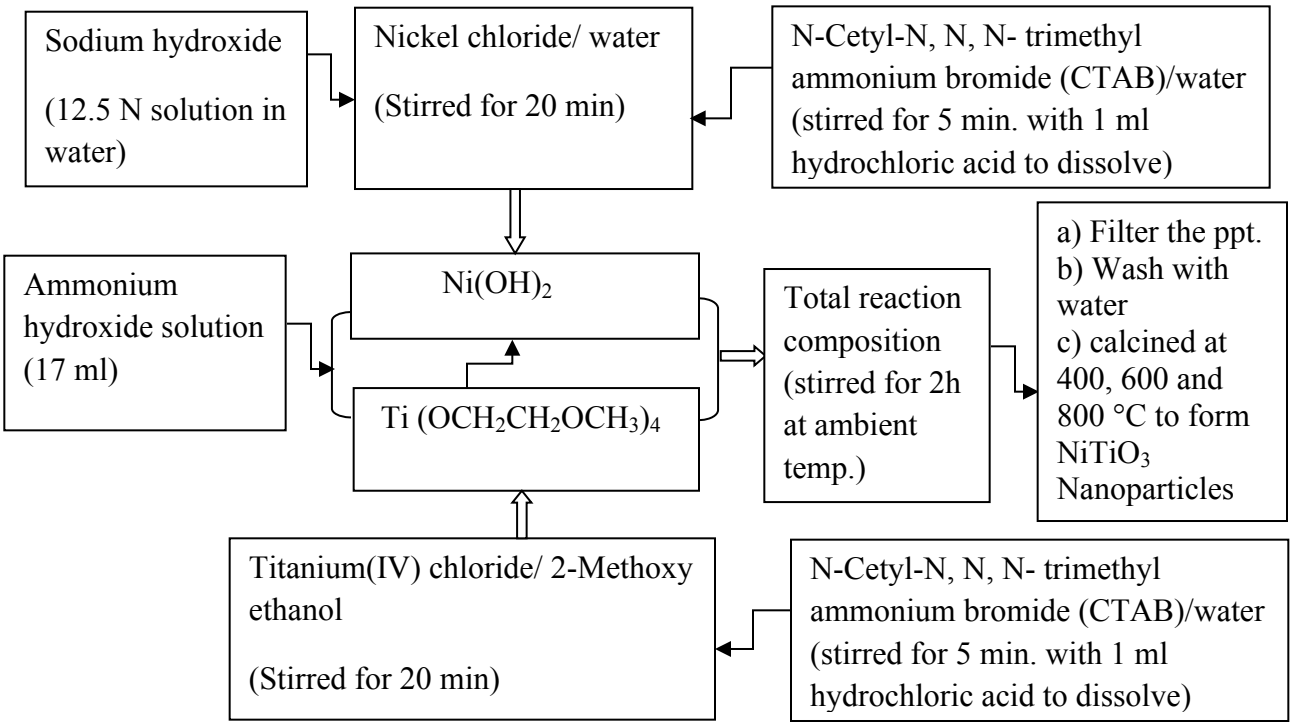
Schematic outline of nickel titanate synthesis by co-precipitation method



Scheme S1. Synthesis of nickel titanate NPs by co-precipitation method at 400, 600 and 800 ° C.

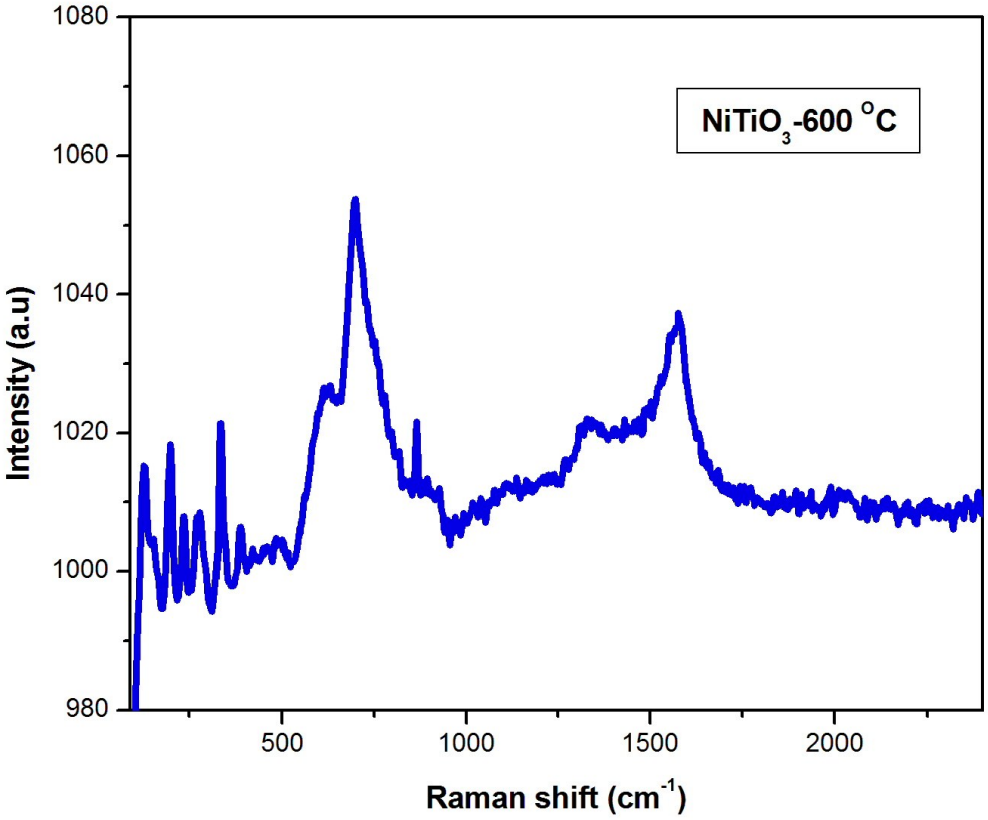


Fig. S1. Raman spectrum depicts the formation of $NiTiO_3$, after calcinated for 4 h at 600 °C.[1]

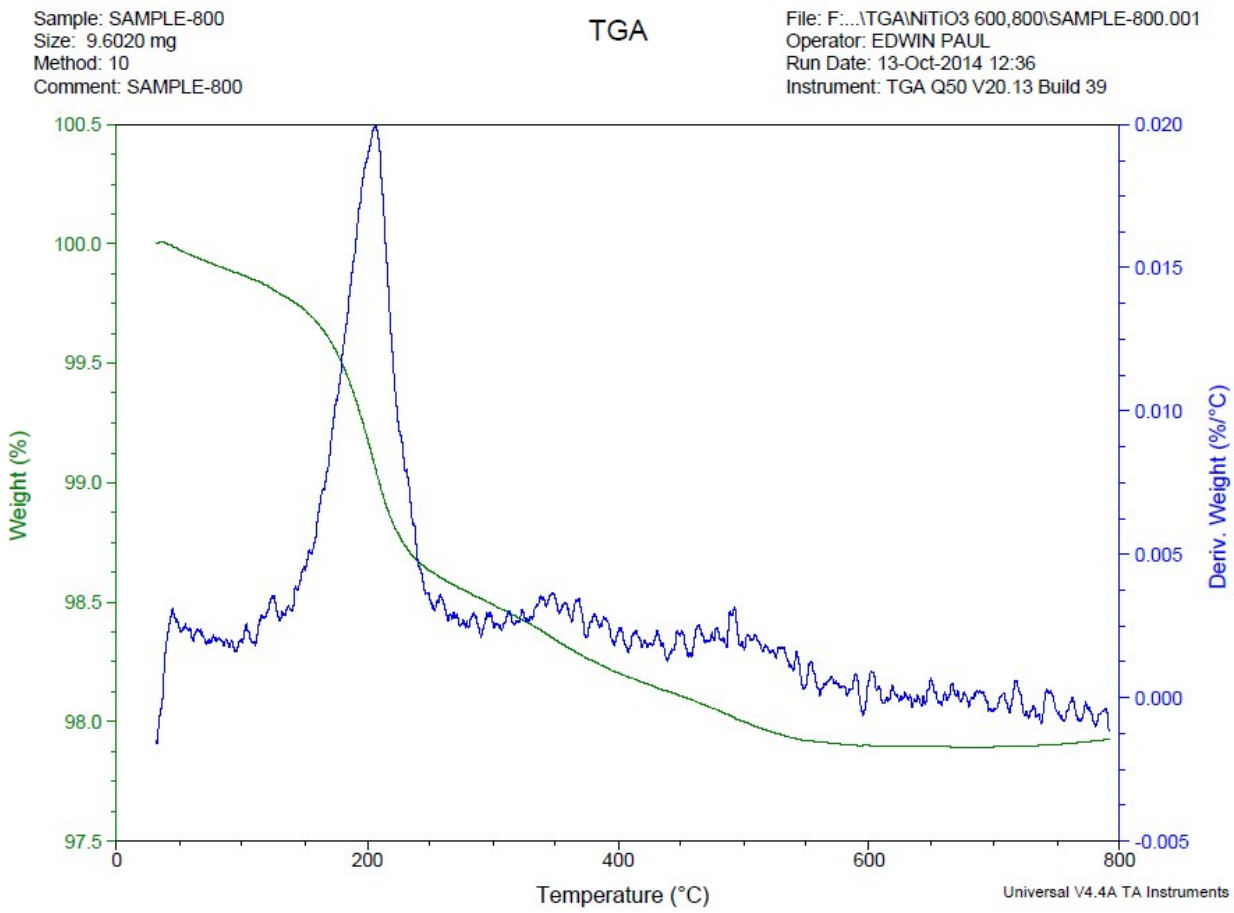


Fig. S2. TGA shows the degradation of $NiTiO_3$ NPs from 25 to 800 °C.

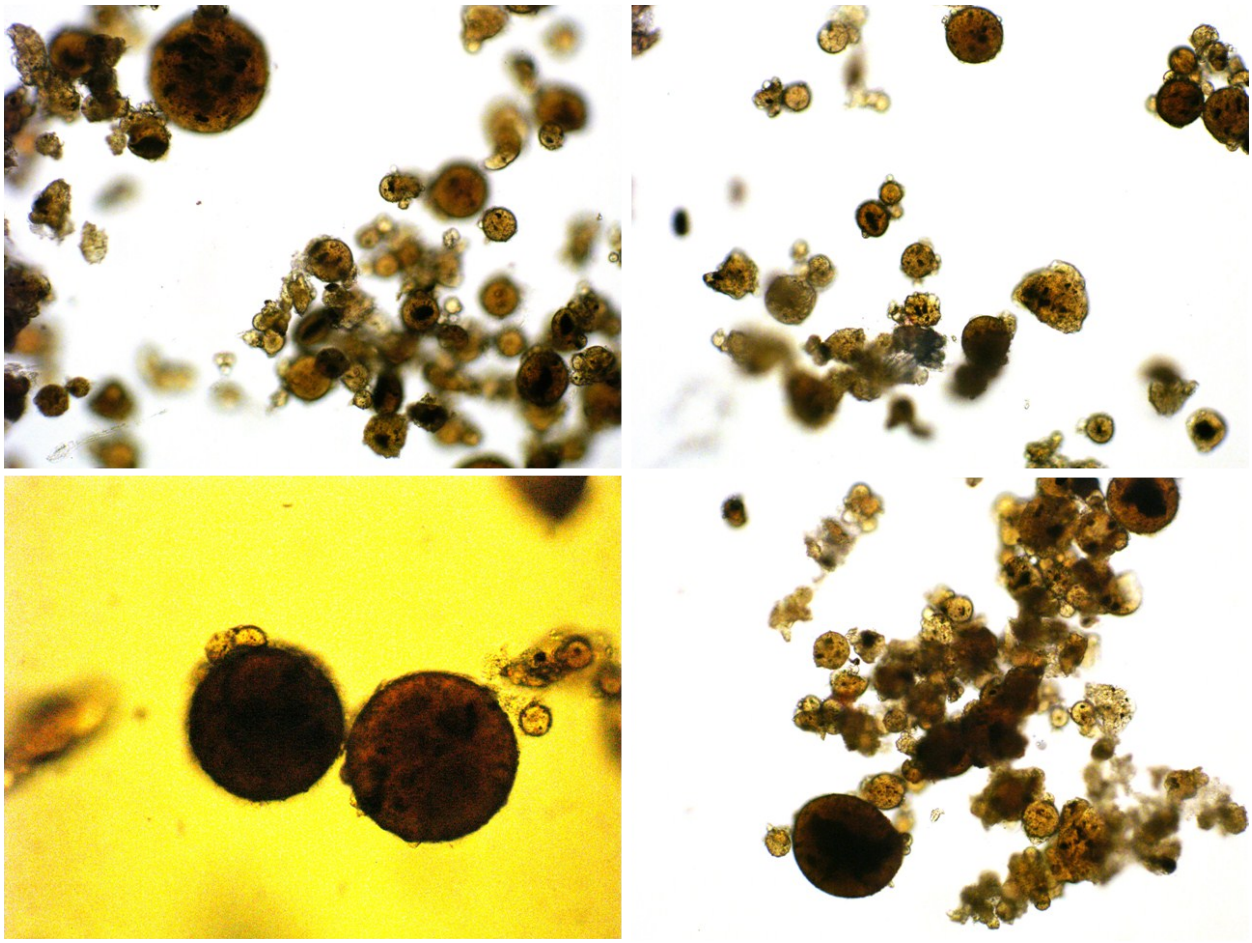


Fig. S3. Optical images of $NiTiO_3$ nanoparticles after calcinated at 800 °C (50 X).

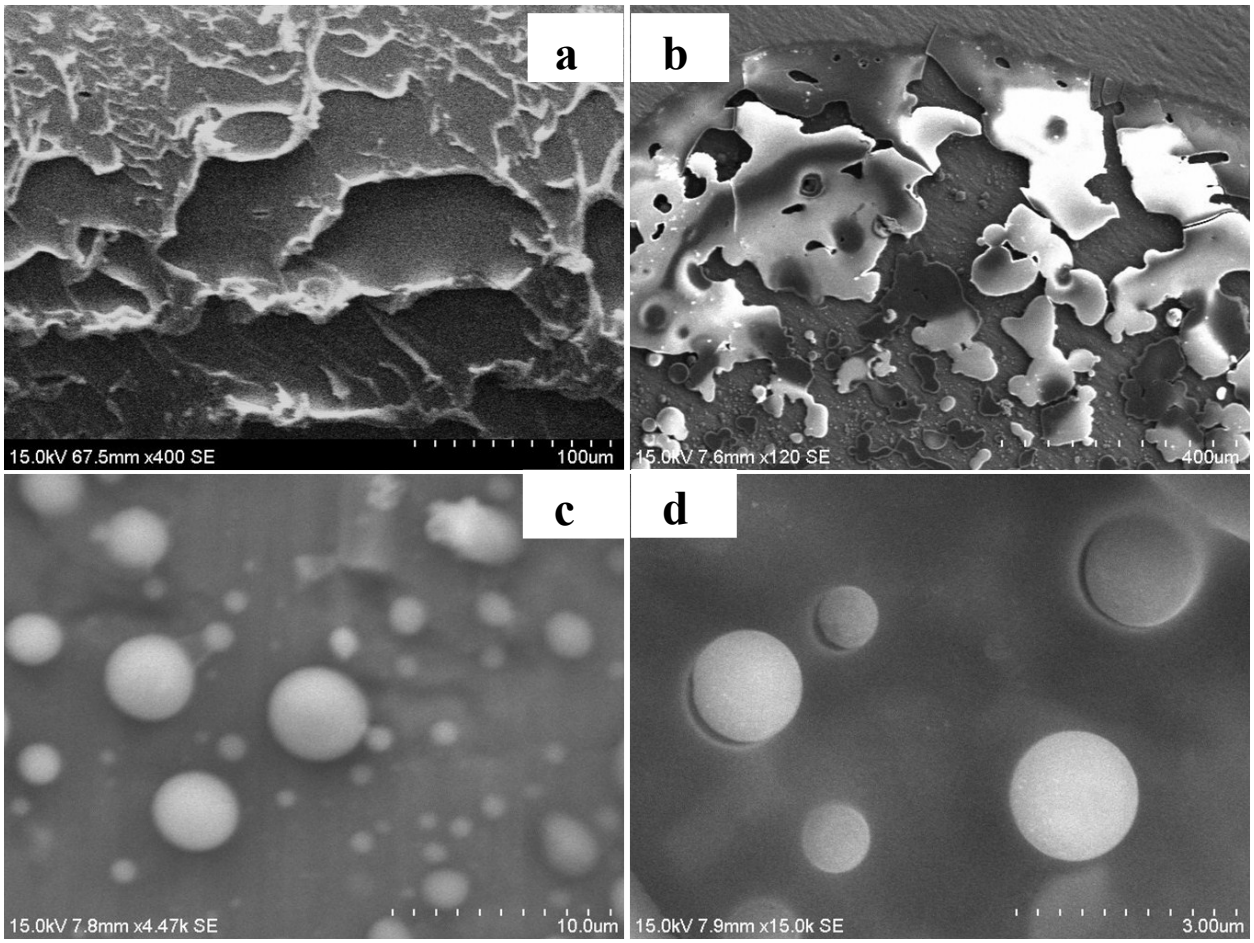


Fig. S4. SEM images of samples a) control PU film b) PU- $NiTiO_3$ nanocomposite film c) $NiTiO_3$ NPs calcinated at 800 °C and d) magnified image of $NiTiO_3$ NPs.[3]

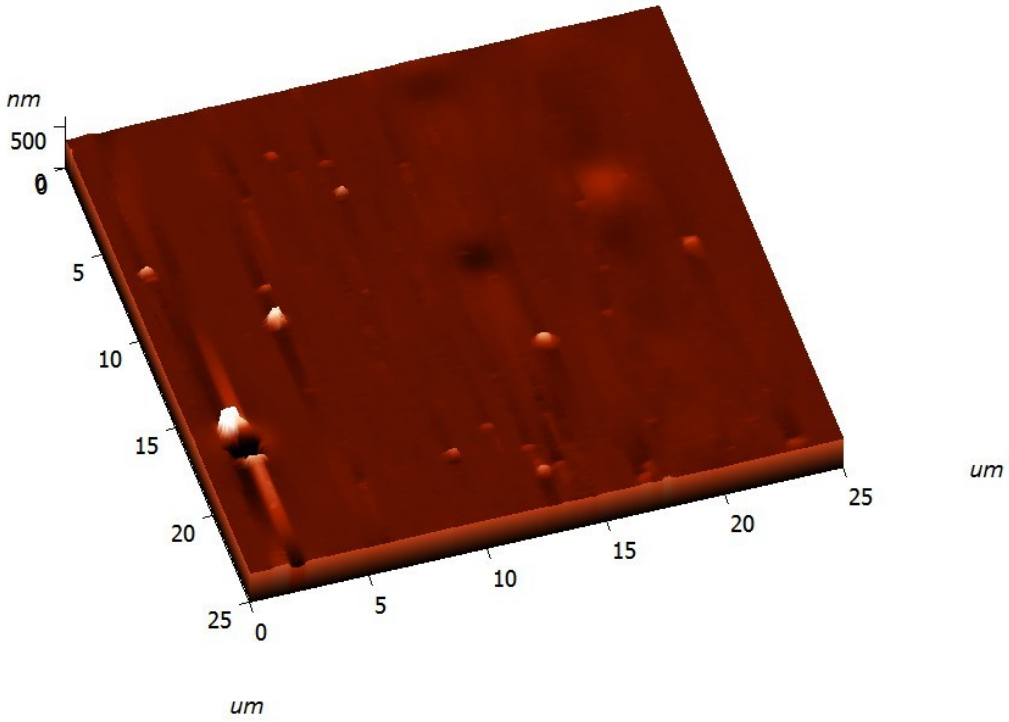


Fig. S5. AFM image of $NiTiO_3$ NPs with height and width profile.[4]

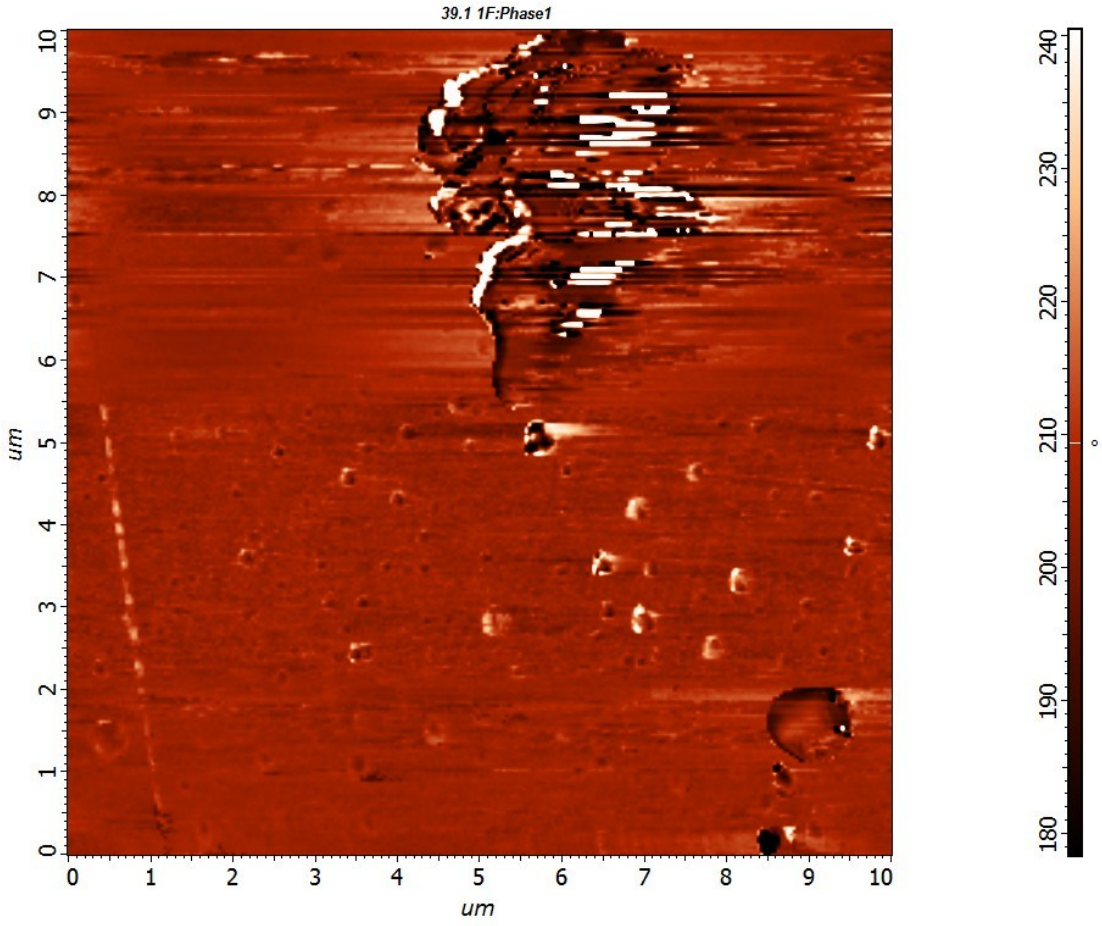


Fig. S6. AFM image of $NiTiO_3$ NPs with phase profile.

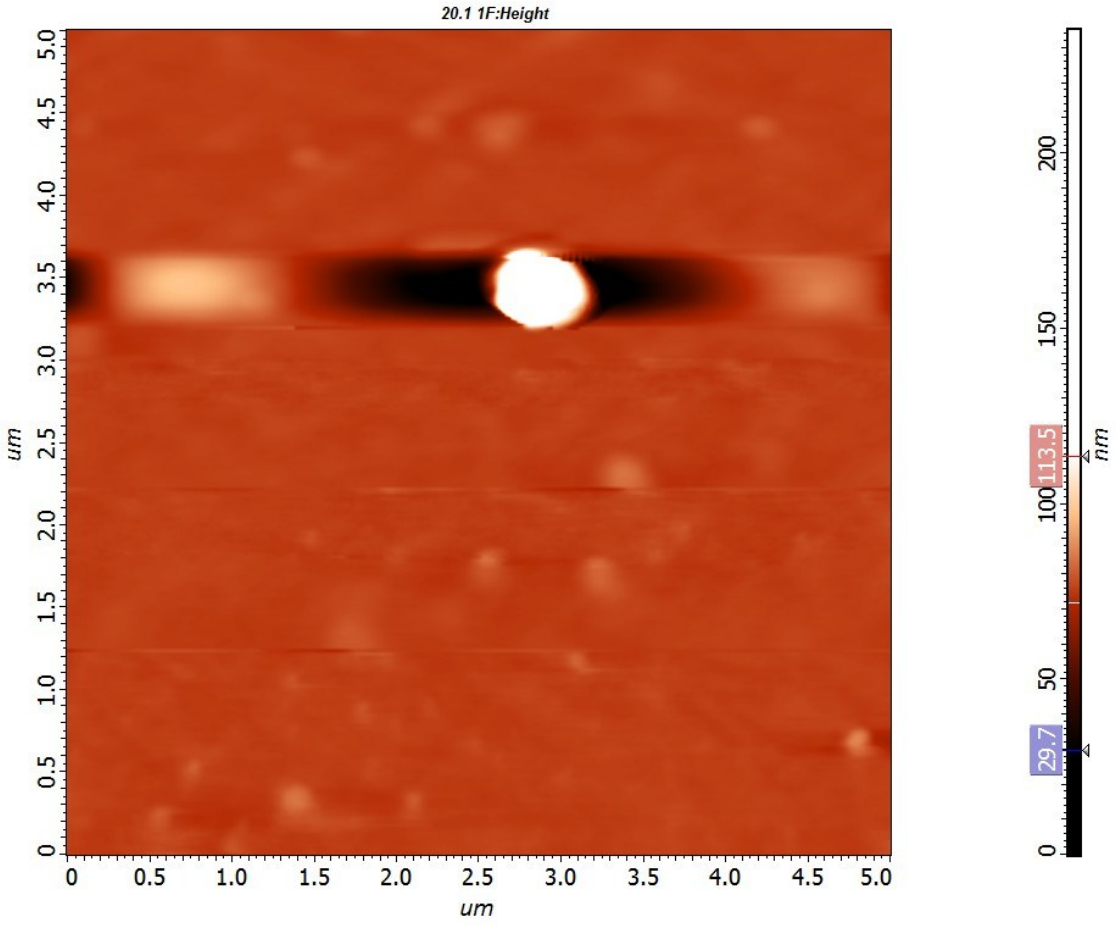


Fig. S7. AFM image of $NiTiO_3$ NPs with height profile.

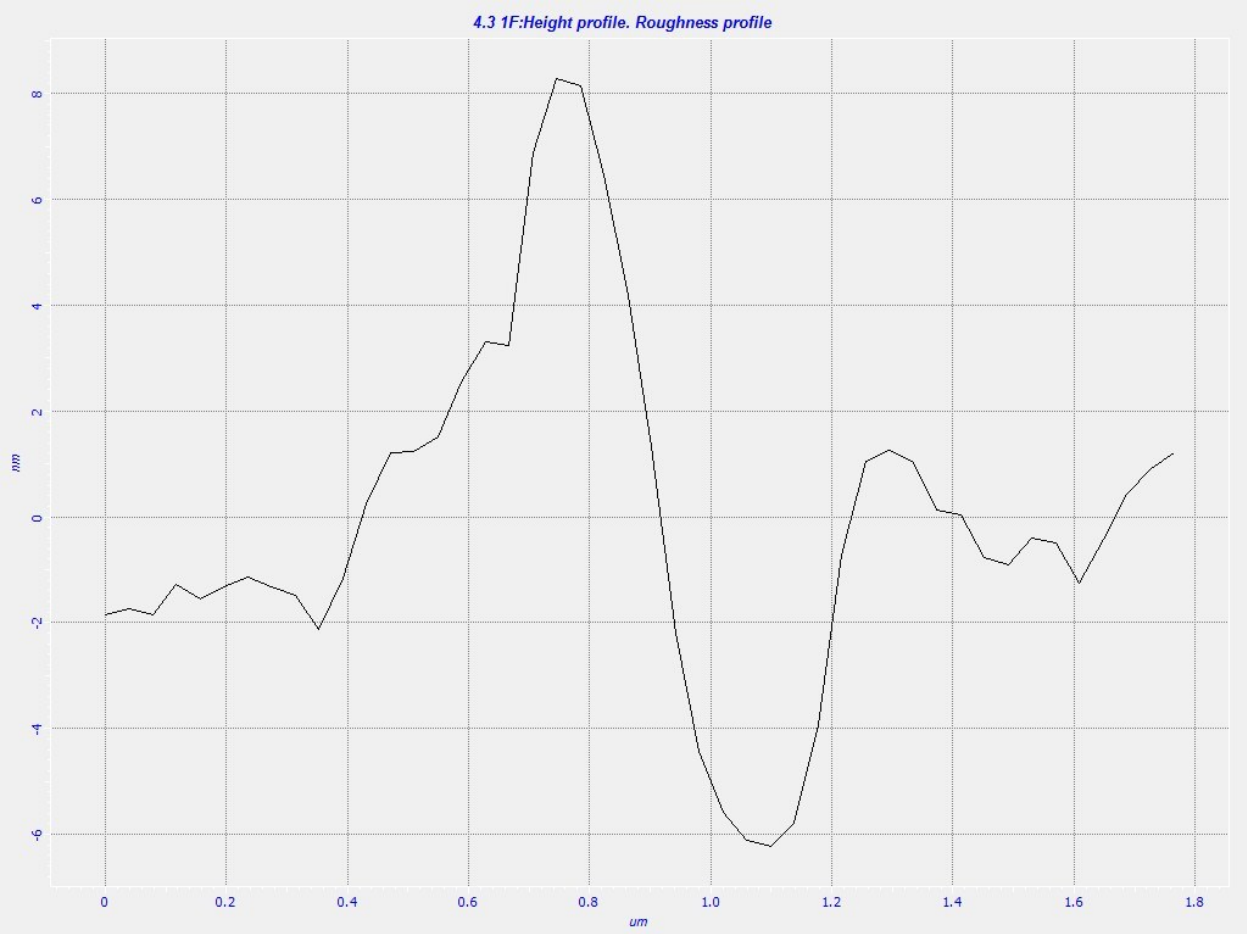


Fig. S8. AFM image of $NiTiO_3$ NPs with roughness (R_q) profile.[5]

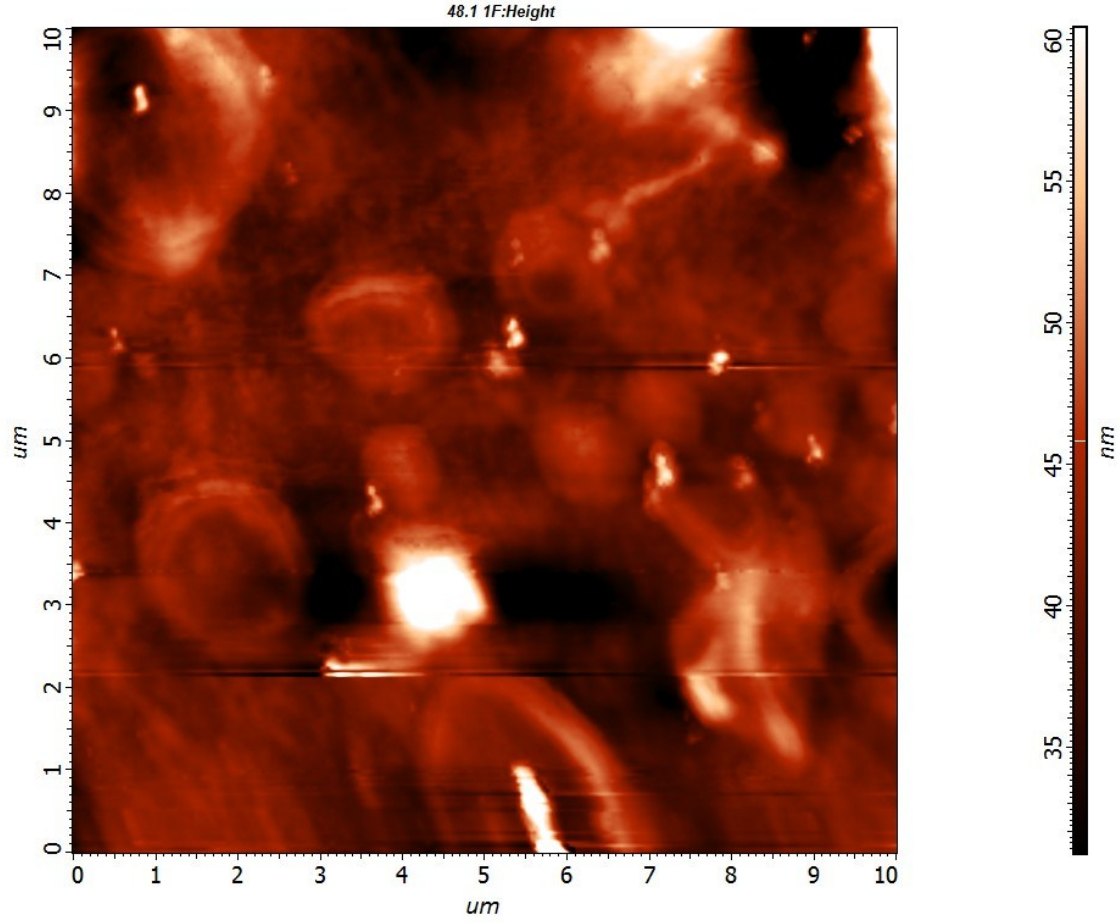


Fig. S9. AFM image of PU-NiTi800 film distributed with $NiTiO_3$ NPs.

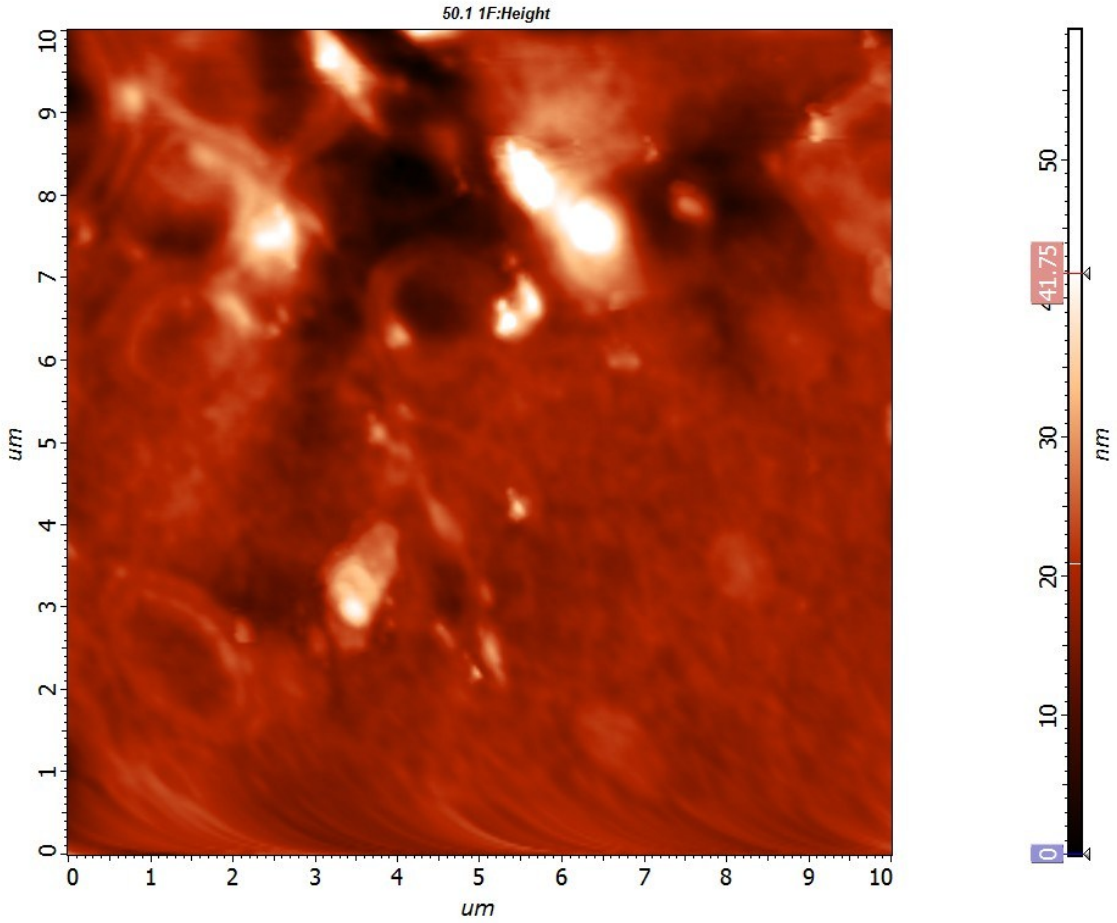


Fig. S10. AFM image of PU-NiTi800 film, $NiTiO_3$ NPs probed on its surface.

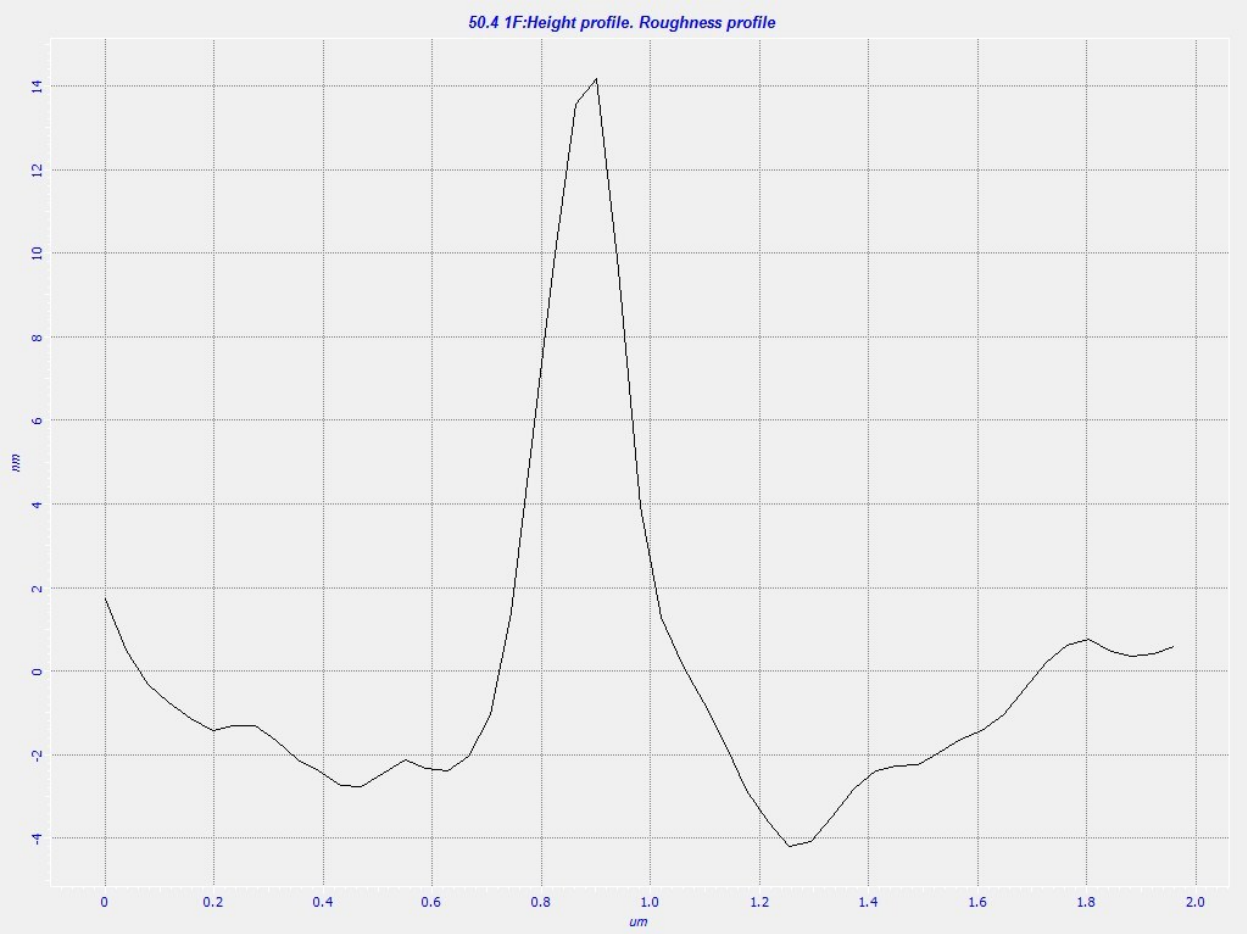


Fig. S11. AFM image of PU-NiTi800 film with roughness (R_q) profile.[6]

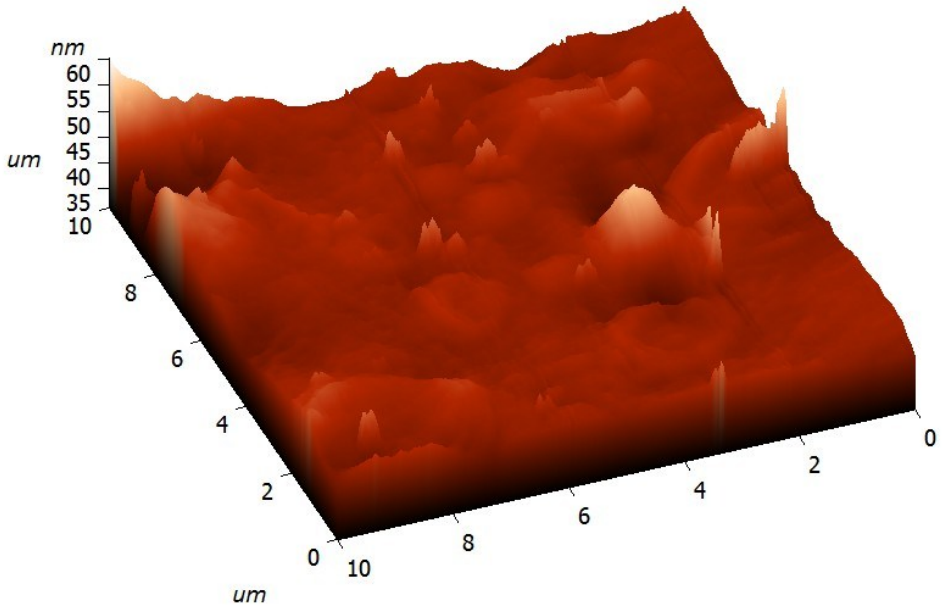


Fig. S12. AFM image of PU-NiTi800 nanocomposite film - 3D surface profile.

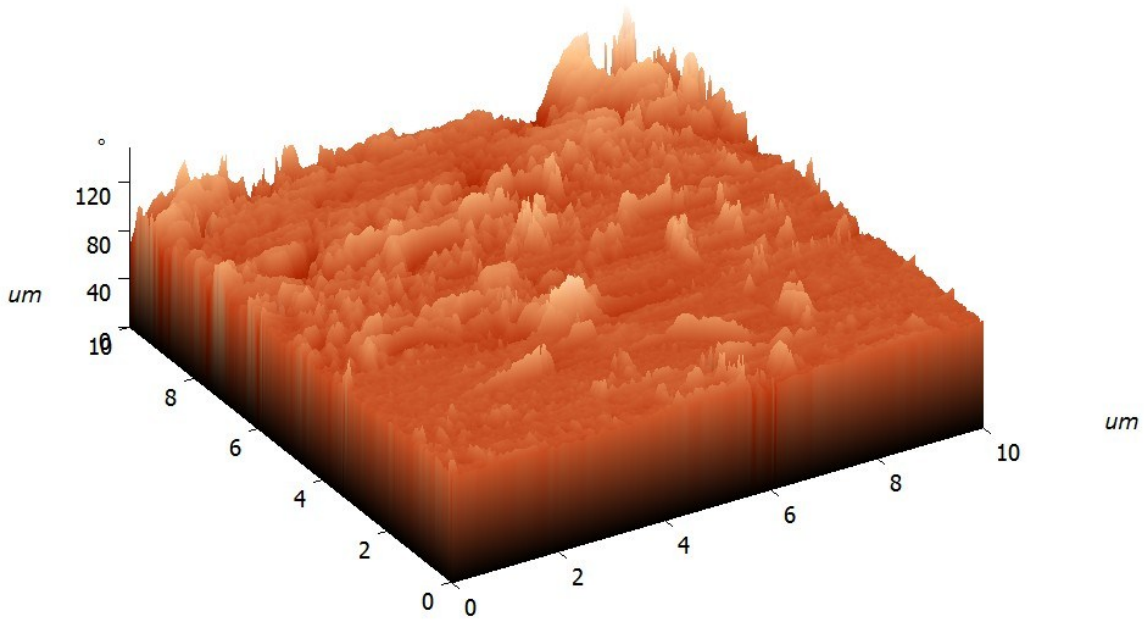


Fig. S13. AFM image of PU-NiTi800 nanocomposite film - 3D surface profile.

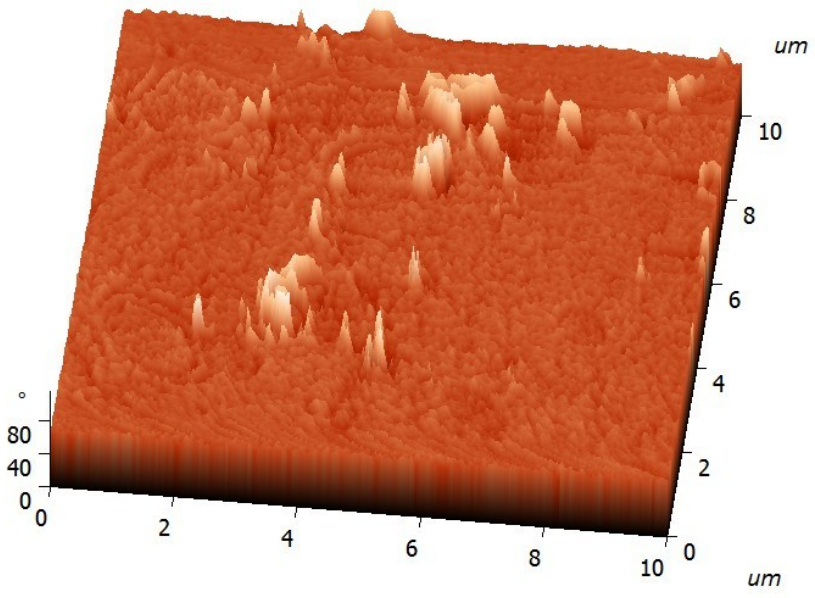


Fig. S14. AFM image of PU-NiTi800 nanocomposite film - 3D topography.

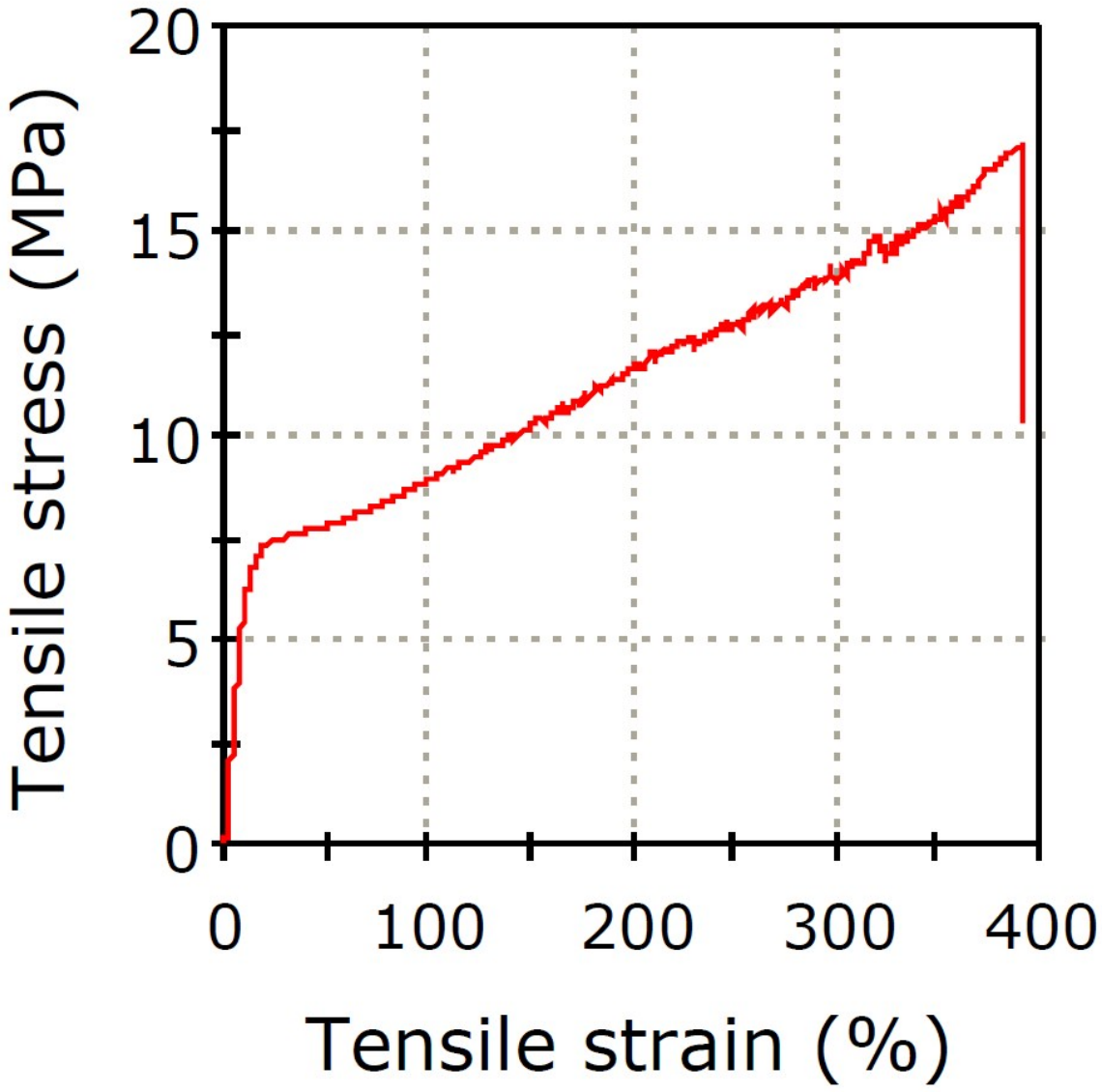


Fig. S15. Tensile profile of control PU film.

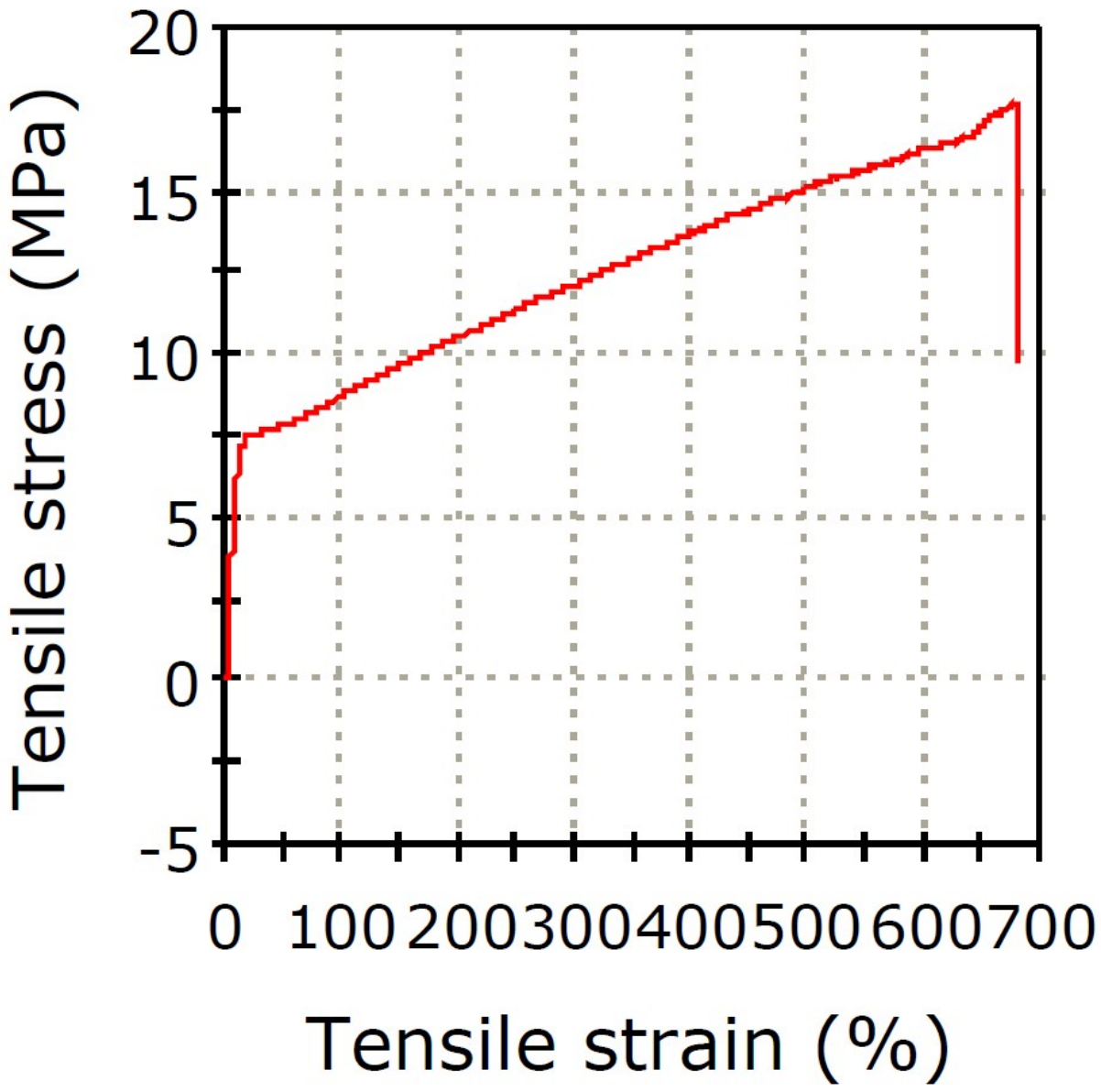


Fig. S16. Tensile profile of PU nanocomposite film, PU-NiTi400.

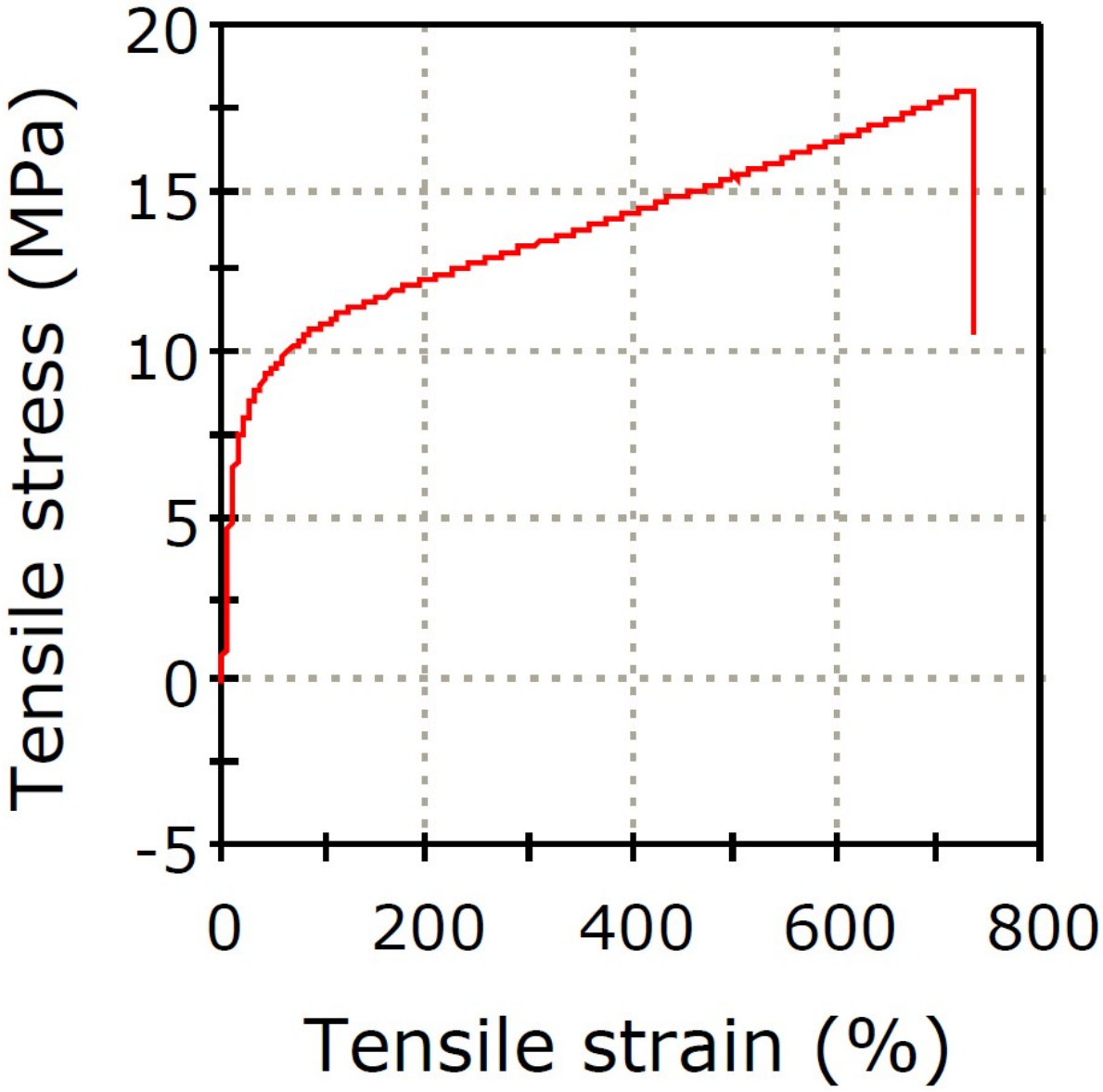


Fig. S17. Tensile profile of PU nanocomposite film, PU-NiTi600.

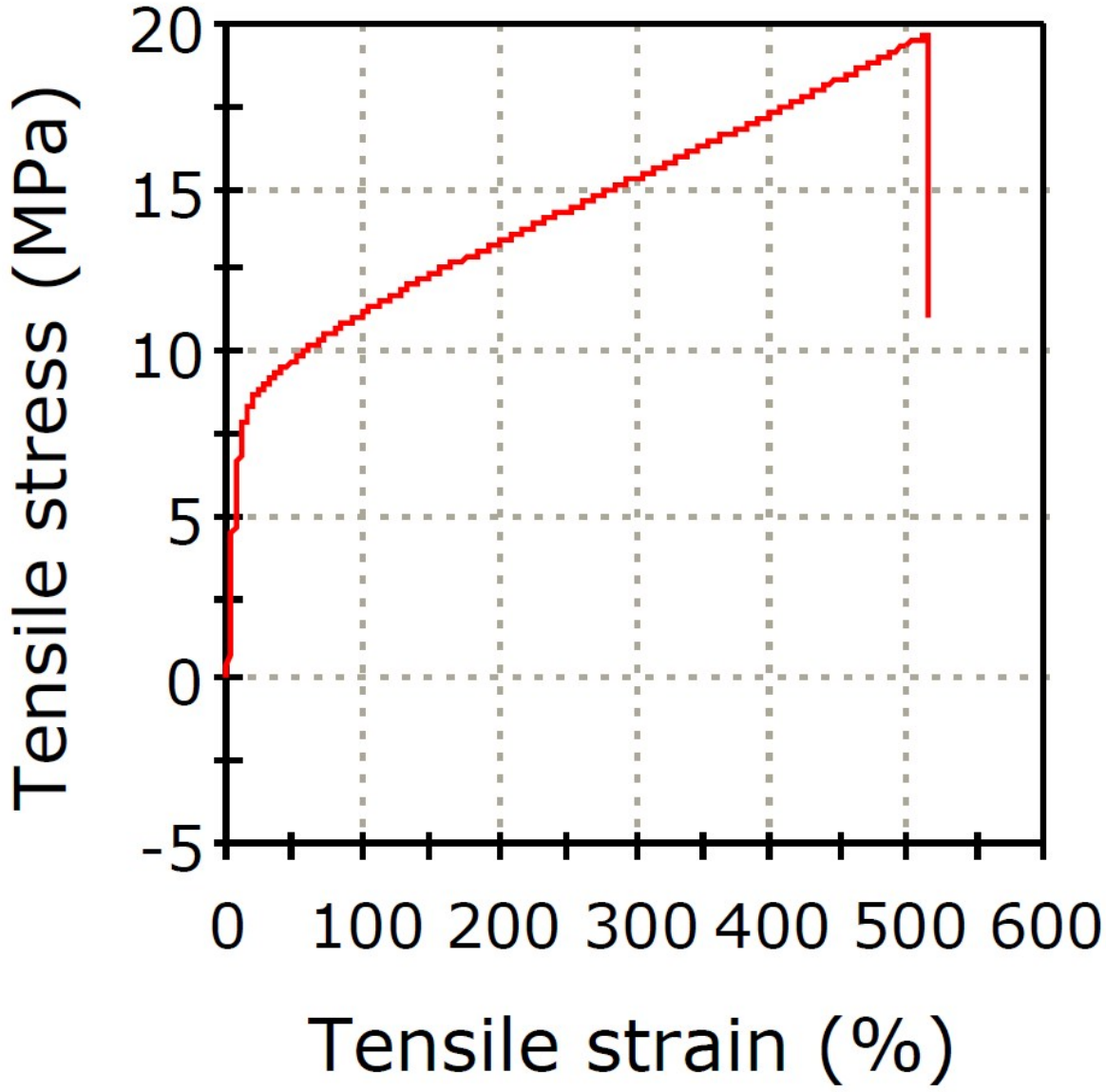


Fig. S18. Tensile profile of PU nanocomposite film, PU-NiTi800.

In mechanical properties study, first one third region of the tensile profile provides information about elastic deformation and the remaining region corresponds to ductile deformation.[7] PU-$NiTiO_3$ nanocomposite samples, PU-NiTi600 and PU-NiTi800 are deduced to exhibit plastic behavior, since the stress-strain curve passes through strain hardening region, which is above the steady state and critical stress.

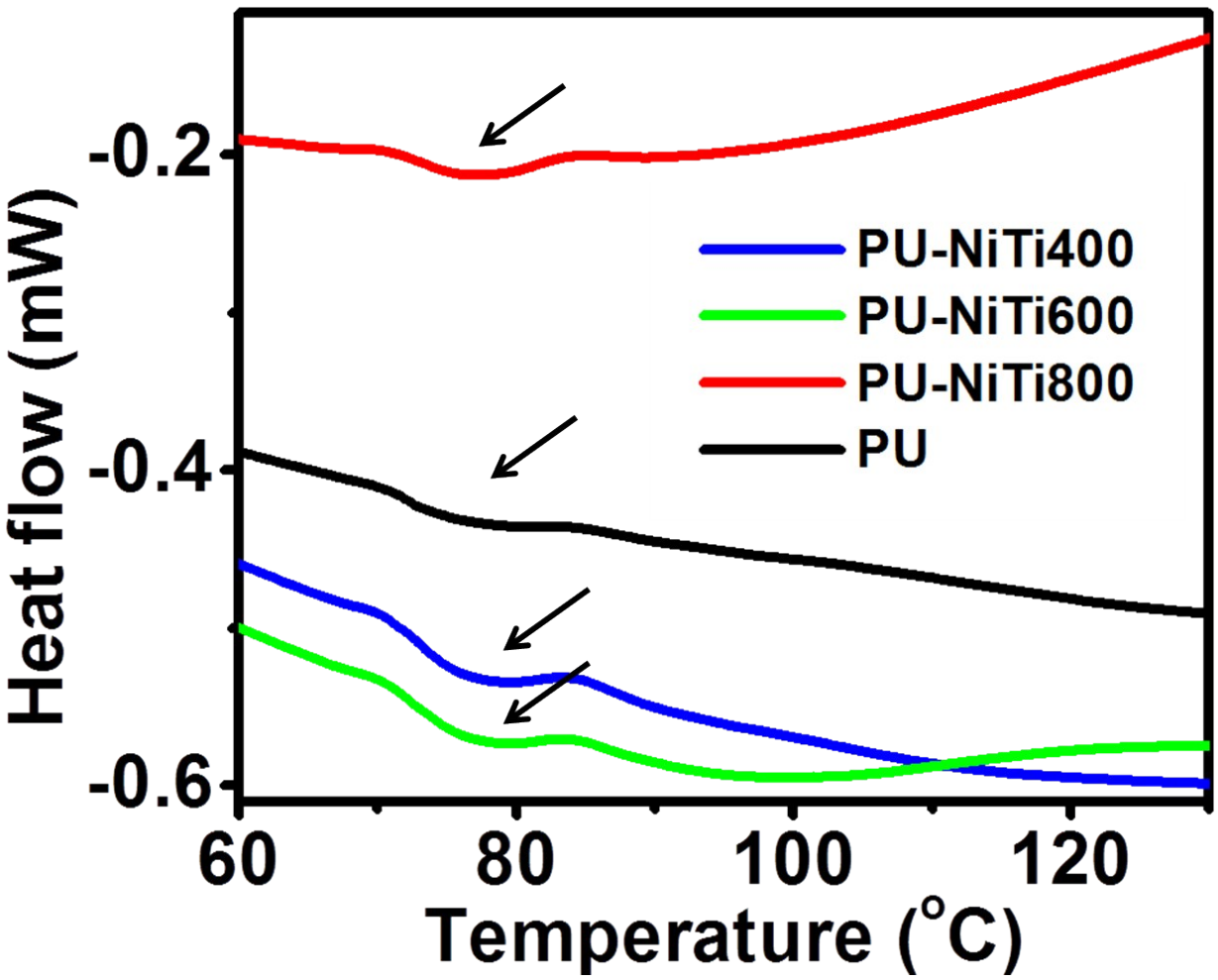


Fig. S19. DSC profile of PU and PU-$NiTiO_3$ films (expanded around the T_g region).

Table S1. ATR-IR data of PU and PU-$NiTiO_3$ nanocomposite films.

S. No.	Sample codes	Urethane (-NH-) [cm^{-1}]	Urethane (-CO-) [cm^{-1}]	PPG Methyl (-C-H) [cm^{-1}]	PPG skeleton (C-O-C) [cm^{-1}]
1	PU	3310	1720	2980	1095
2	PU-NiTi400	3300	1705	2975	1082
3	PU-NiTi600	3014	1652	3011	1086
4	PU-NiTi800	3283	1639	2947	1094

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