**Supplementary Information for**
**High tensile strength and transformation-induced plasticity**
**in bulk polycrystalline omega titanium**

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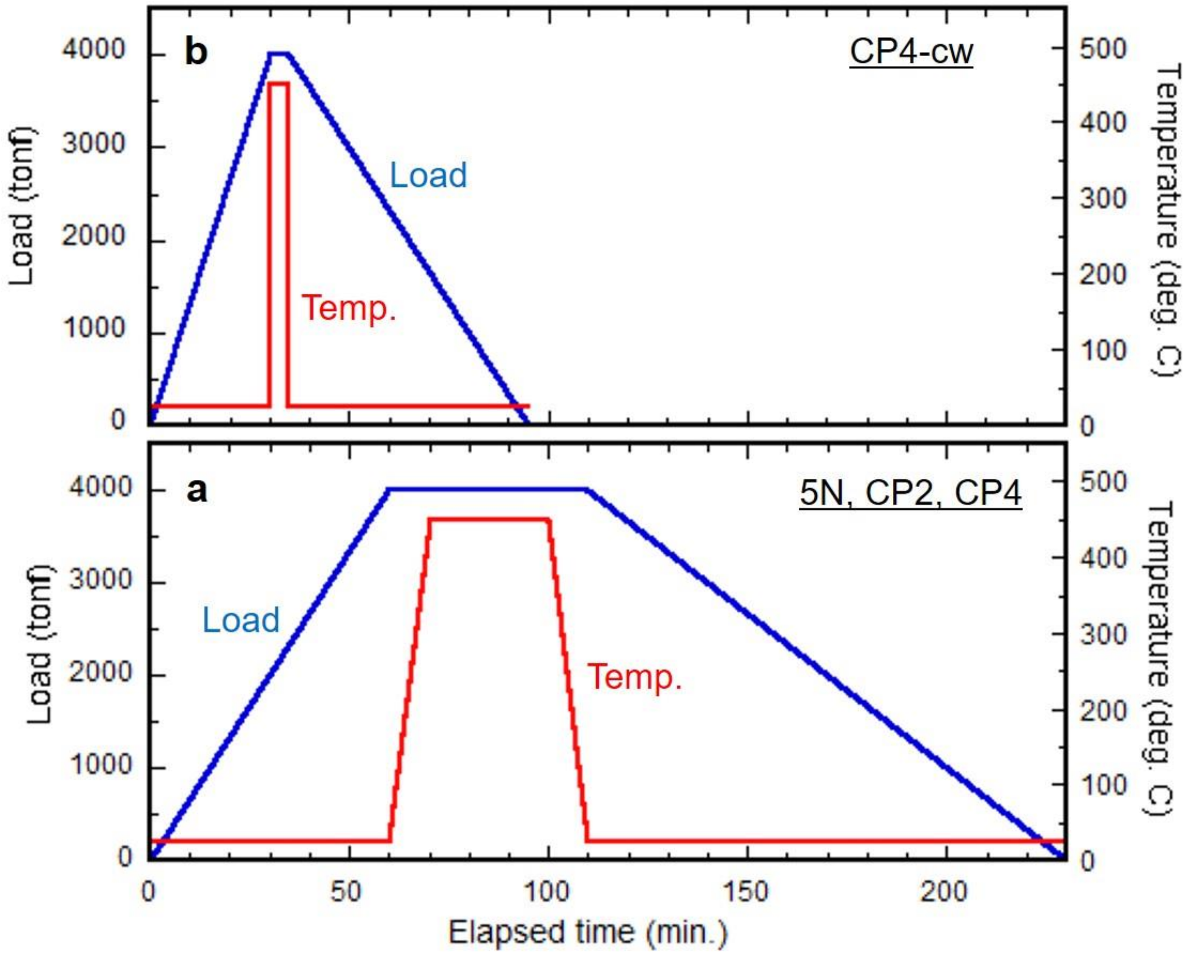
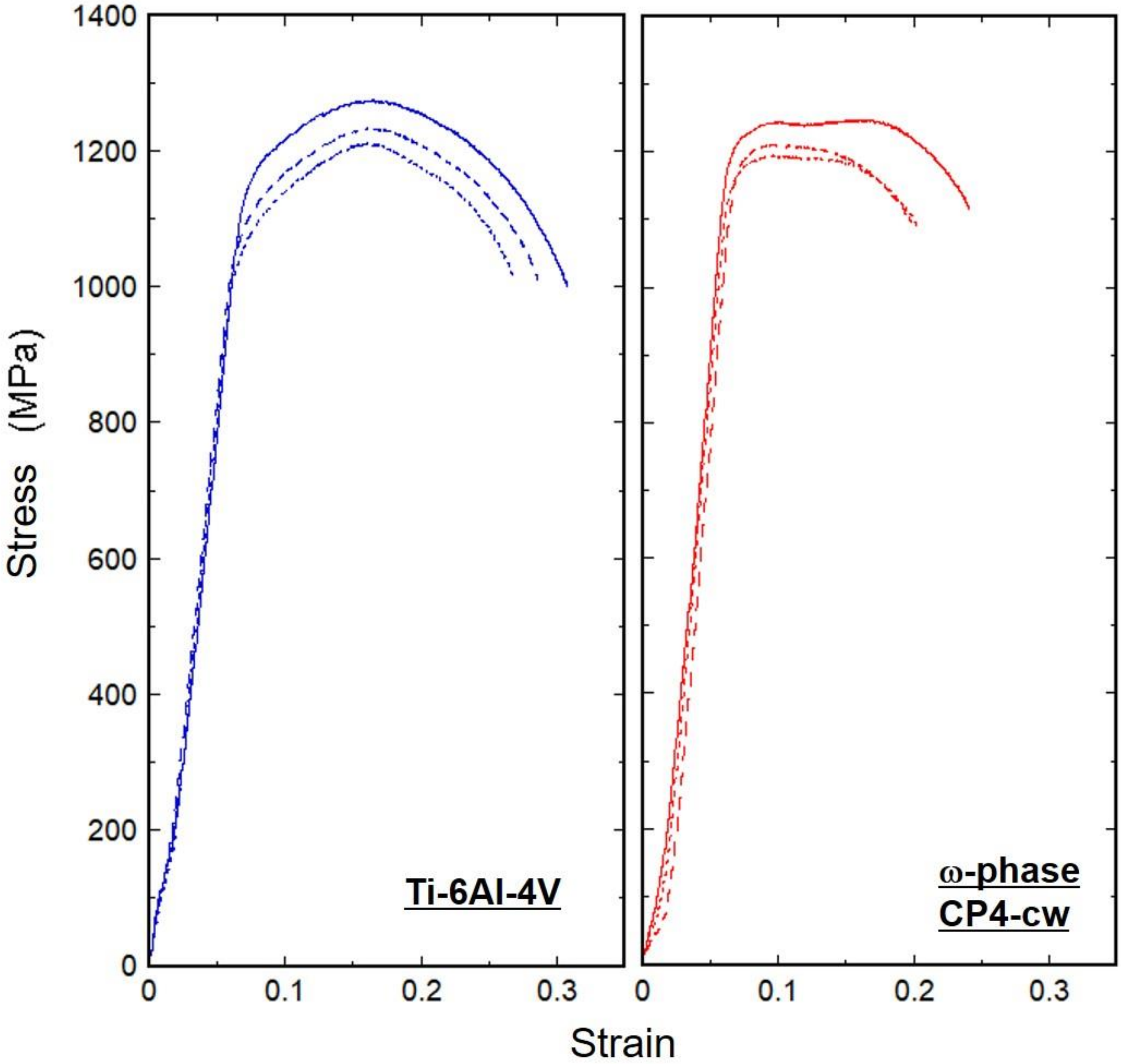
**Supplementary Table 1**. Minor element contents of commercially pure titanium materials employed as starting materials in this study.

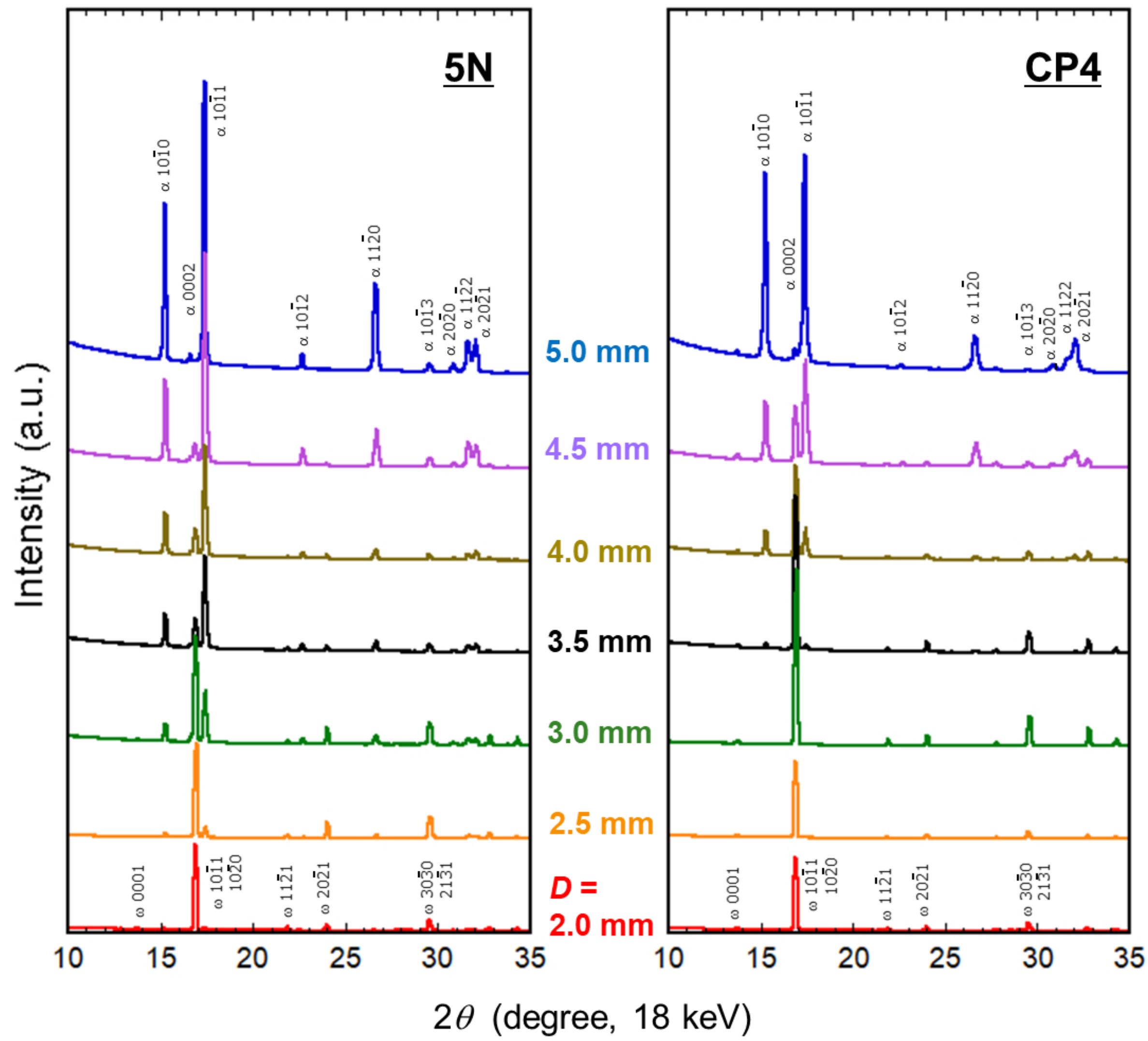
| | CP2 (wt%) | CP4 (wt%) | CP4-cw (wt%) |
|---|---|---|---|
| specification | ASTM B348-GR2 | ASTM F67-13 | ASTM F67-13 |
| Sn | - | <0.005 | 0.015 |
| Mo | - | <0.001 | <0.001 |
| Zr | - | <0.001 | <0.001 |
| Cu | - | 0.004 | 0.004 |
| Fe | 0.09 | 0.07 | 0.07 |
| Mn | - | <0.001 | <0.001 |
| V | - | 0.003 | <0.003 |
| Si | - | <0.002 | 0.009 |
| Al | - | 0.009 | 0.006 |
| C | <0.01 | 0.054 | 0.067 |
| **O** | **0.12** | **0.38** | **0.37** |
| N | 0.01 | 0.009 | 0.004 |
| Ni | - | 0.0020 | 0.0016 |
| Cr | - | <0.001 | <0.001 |
| B | - | <0.001 | <0.001 |
| Y | - | <0.0004 | <0.0004 |
| H | <10 ppm | 2 ppm | 8 ppm |
| residual | - | <0.2 | <0.3 |
| grain size | data not shown | 9 μm | 10 μm |



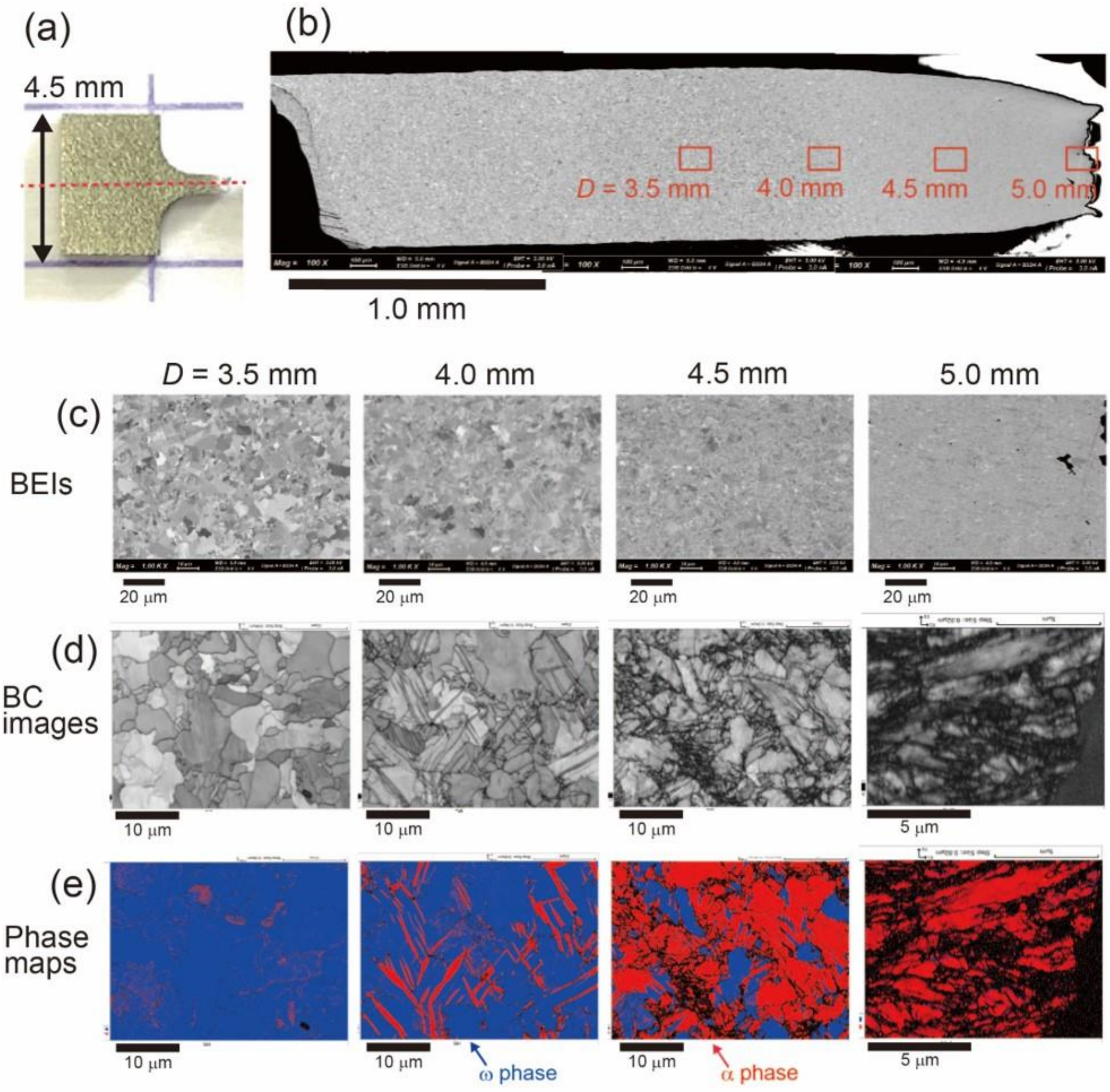

**Supplementary Figure 1.** Load and temperature profiles as a function of elapsed time to fabricate ω-phase materials under high pressure and temperature. a) The profiles employed to fabricate the ω-phase materials from 5N, CP2, and CP4 starting materials. b) The profile employed to fabricate the ω-phase material from CP4-cw starting material. The ω-phase material with the grain size of 3.4 μm was obtained by employing the short heating time (5 min.) under high-*PT* with rapid heating and cooling processes.



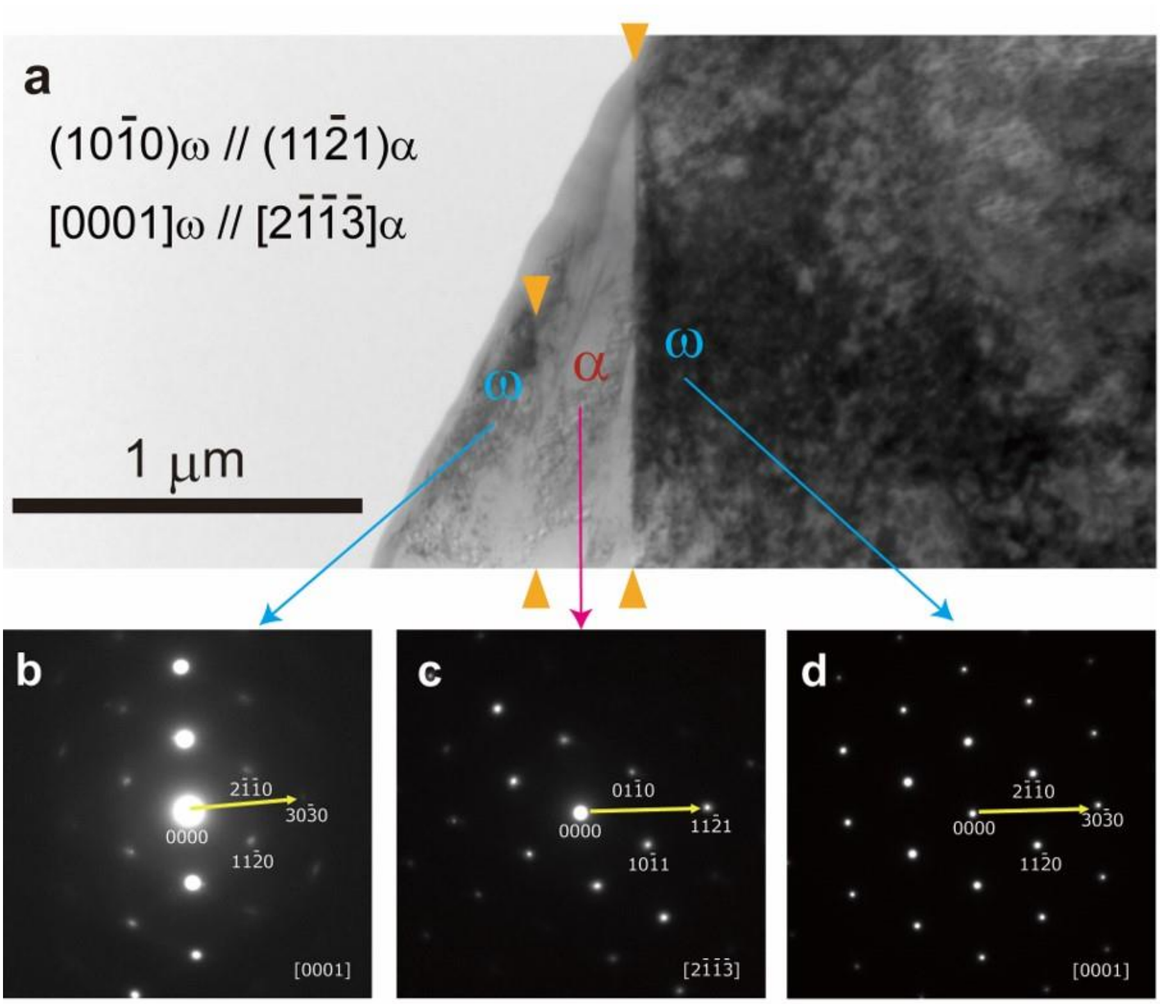

**Supplementary Figure 2.** Stress-strain curves of Ti-6Al-4V and the ω-phase material fabricated from cold-worked CP-Ti Grade 4. Results of three miniature tensile tests are displayed for each material. It is noteworthy that the ultimate tensile strength of the ω-phase material is comparable to that of Ti-6Al-4V, while the 0.2% offset yield strength of the ω-phase material is greater than that of Ti-6Al-4V.



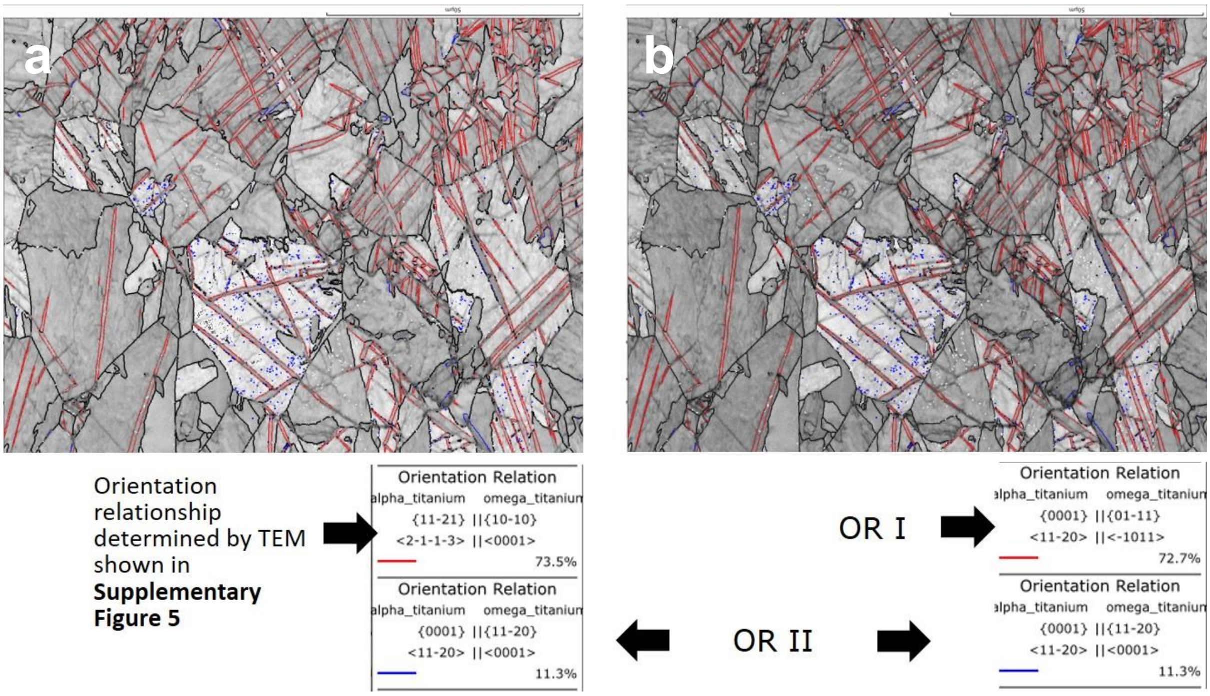

**Supplementary Figure 3.** X-ray diffraction profiles obtained from fractured ω phase tensile specimens with 5N and CP-Ti Grade 4 compositions. X-ray diffraction spectra were collected at different $D$ positions from $D$ = 2.0 mm (in the grip section) to $D$ = 5.0 mm (the position including fracture surface). These observations suggest that tensile stress induces a back-transformation from the ω phase to the α phase.




**Supplementary Figure 4.** Microstructure observations of fractured ω-titanium tensile specimen. The ω phase material was fabricated from CP4. a) A fractured specimen; b) a back-scattered electron image (BEI) to show the positions for detailed observations; c) BEIs; d) band-contrast (BC) images; e) phase maps obtained from EBSD data.




**Supplementary Figure 5.** Results of transmission electron microscope observations and electron diffraction measurements. These data were obtained by using a fractured specimen after a tensile test of bulk polycrystalline ω-Ti with CP2 composition. A thin specimen with thickness less than 100 nm was prepared at $D$ = 3.75 mm (see Fig. 5) using a focused ion beam (FIB) technique. a) A bright field image showing the presence of lamellar α-phase within a ω grain. The interfaces of these two phases are flat and nearly perpendicular to the image. b), c), and d) Electron diffraction patterns obtained at positions shown in a). The orientation relationship between ω and α phases is determined using these electron diffraction patterns. The obtained relationship is as follows: (10-10)ω ∥ (11-21)α, [0001]ω ∥ [2-1-1-3]α. This relationship is identical to Variant I (OR I) determined in previous studies. These results obtained by TEM observations are consistent with those obtained by the FESEM-EBSD technique (Fig. 5).




**Supplementary Figure 6.** EBSD grain boundary maps. These two band contrast (BC) images are identical. This image was obtained at $D = 3.75$ mm (see Fig. 5 and text) where the presence of thin lamellar α-phase was observed within the ω grains. In a), ω/α grain boundaries that satisfy the orientation relation determined by TEM observation (Supplementary Figure 5) are represented in red lines. In b), ω/α grain boundaries that satisfy the orientation relation proposed in previous studies, OR I, are also represented in red lines. In these images, ω/α grain boundaries that satisfiy OR II (see text) are shown in blue. Since the observed orientation relationship by TEM is identical to that of OR I, these two images look very similar.