Design of super-strong and thermally stable nanotwinned Al alloys via solute synergy

Supplymentary Materials

Y.F. Zhang[*a], R. Su[a], Dongyue Xie [c], T.J. Niu[a], S. Xue[a], Q. Li[a], Z. Shang, J. Ding[a], N.A. Richter[a], Jian Wang [c], H. Wang[a, b], X. Zhang*[a]*

[a] *School of Materials Engineering, Purdue University, West Lafayette, IN 47907, United States*

[b] *School of Electrical and Computer Engineering, Purdue University, West Lafayette, IN 47907*

[c] *Mechanical and Materials Engineering, University of Nebraska-Lincoln, Lincoln, NE 68588, USA*

**Corresponding author: X. Zhang, xzhang98@purdue.edu; Y.F. Zhang, zhan2592@purdue.edu;*

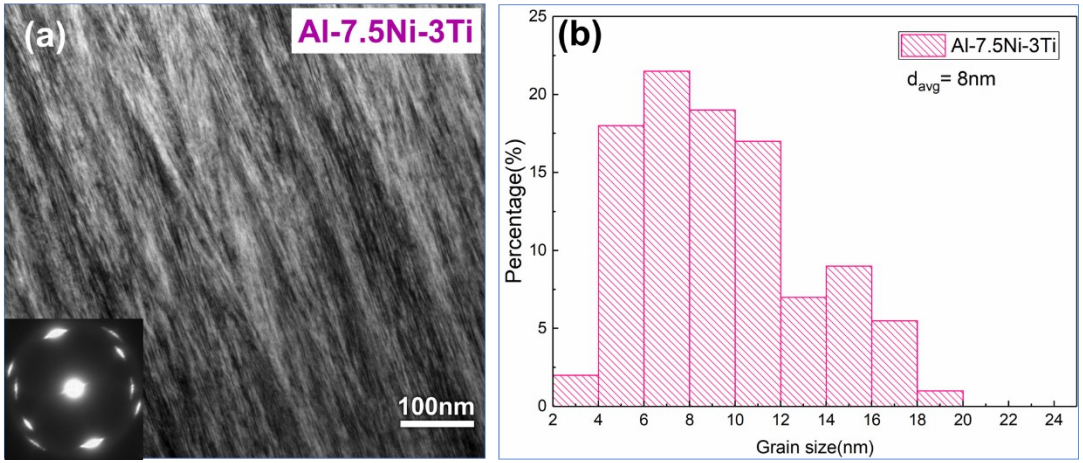

Figure S1. (a) Low-mag XTEM micrograph with SAD pattern revealing the NT columnar structure in the Al-7.5Ni-3Ti. (b) The corresponding statistics showing an average grain size of 8 nm.

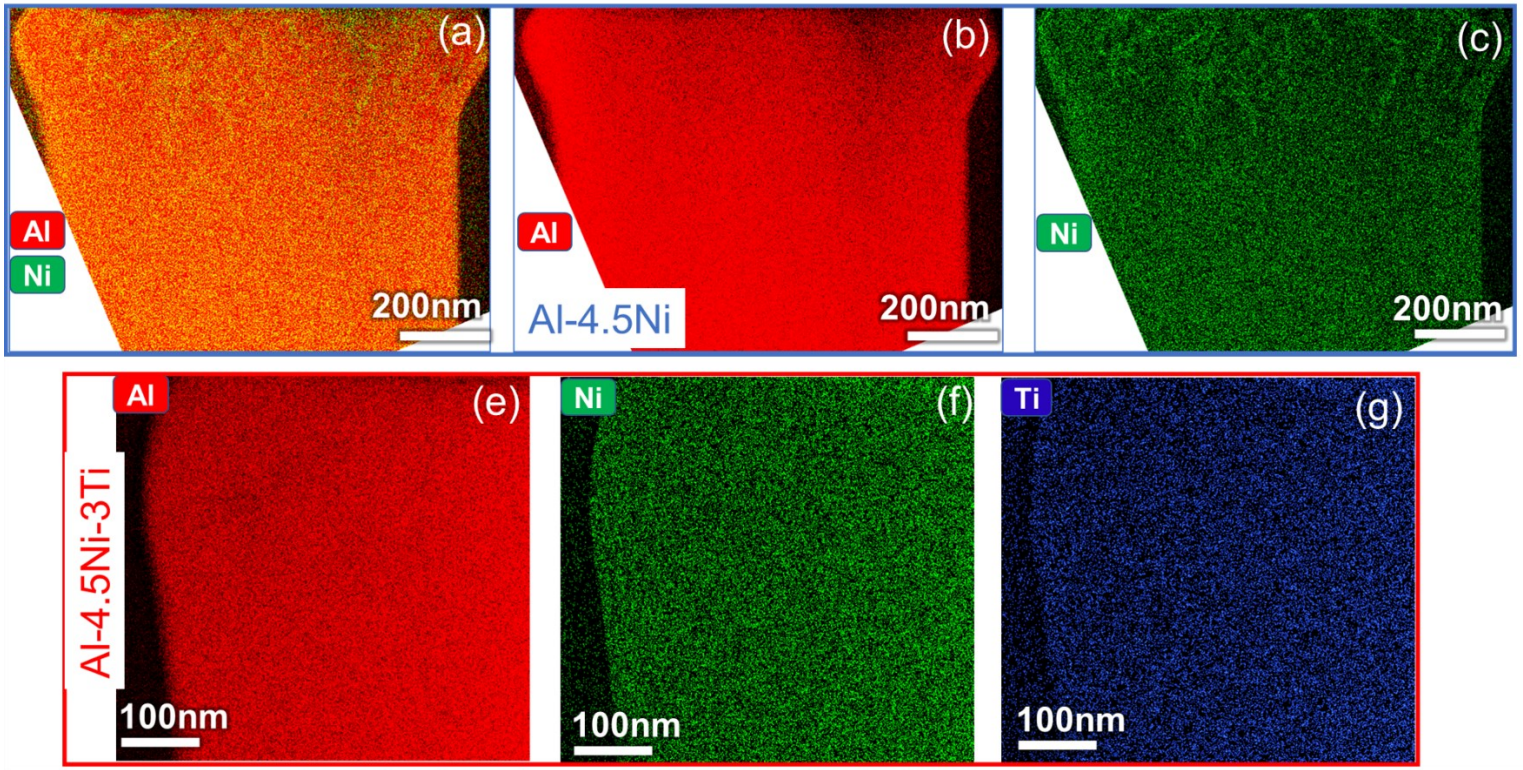

Figure S2. (a-c) EDS maps showing the Ni segregation at the top of deformed Al-4.5Ni pillar. (e-g) EDS maps demonstrating the uniform distribution of Al, Ni and Ti in the deformed Al-4.5Ni-3Ti pillar.

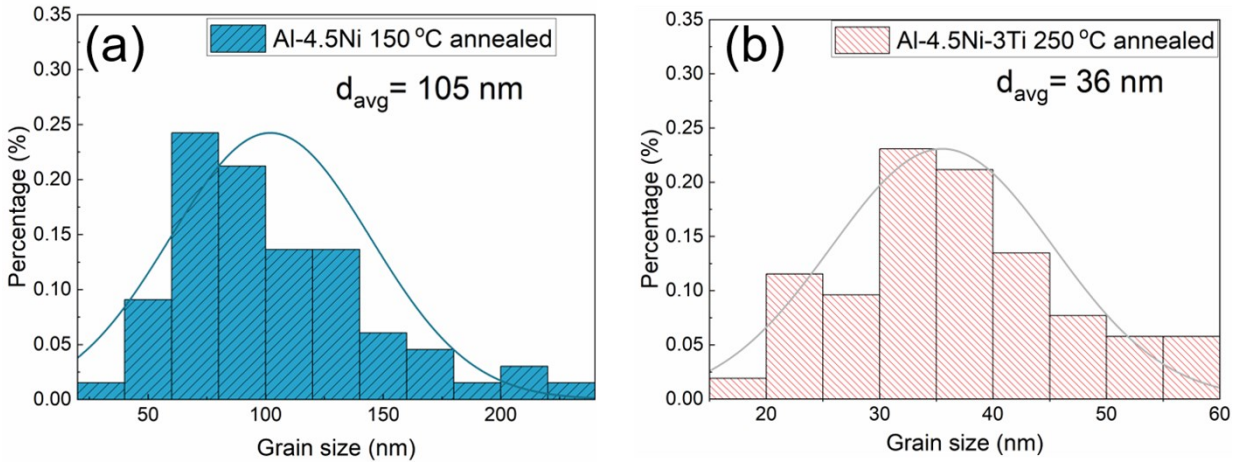

Figure S3. Statistics showing grain size distributions in annealed Al-4.5Ni (a), and annealed Al-4.5Ni-3Ti alloys.

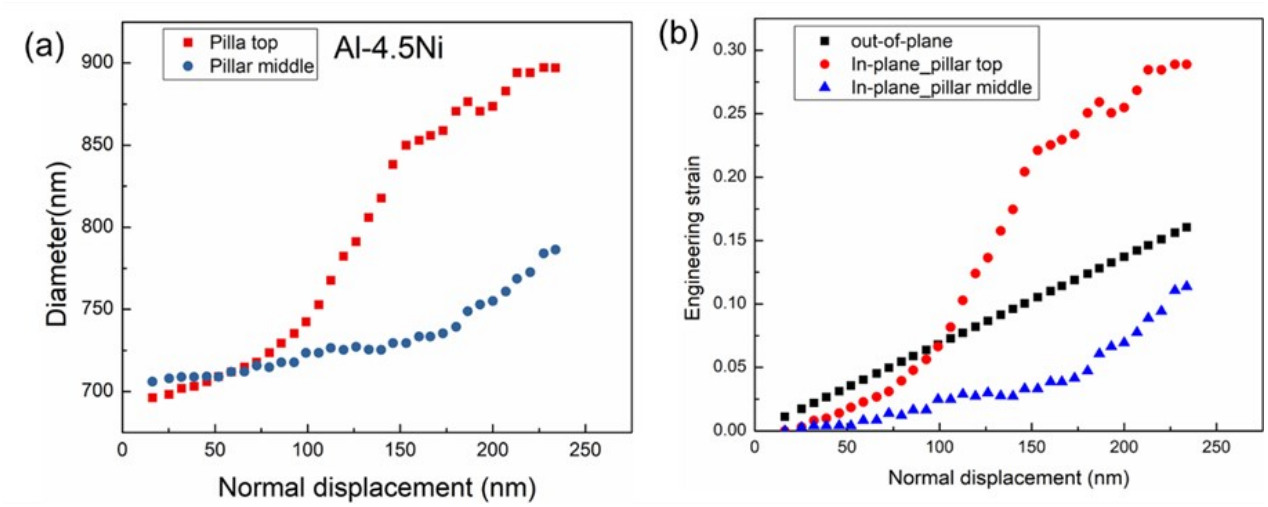

Figure S4. (a) Instantaneous diameters on the top and middle of Al-4.5Ni pillar. (b) In-plane and out-of-plane strains plotted as a function of normal displacement for Al-4.5Ni pillar.

Supplementary Video 1. In situ SEM video showing the micropillar compression of Al-4.5Ni up to 16% engineering strain.

Supplementary Video 2. Pillar compression of Al-4.5Ni-3Ti up to 16% engineering strain.