

Description of Additional Supplementary Files

Supplementary Data 1: Input structure for the molecular dynamics simulation of the deformation of Cu-ANP composite under shearing loading.

Supplementary Data 2: Output structure from the molecular dynamics simulation of the deformation of Cu-ANP composite after 30,000 steps of structural relaxation and 2,001,000 steps of shearing with a constant velocity of 0.001 Angstrom/ps for the upper and lower layers.

Supplementary Data 3: Input structure for the molecular dynamics simulation of the deformation of Cu-CNP composite under shearing loading.

Supplementary Data 4: Output structure from the molecular dynamics simulation of the deformation of Cu-CNP composite after 30,000 steps of structural relaxation and 2,001,000 steps of shearing with a constant velocity of 0.001 Angstrom/ps for the upper and lower layers.

Supplementary Movie 1: MD simulations of dislocation-ANP interactions during deformation. The video speed is accelerated five times.

Supplementary Movie 2: The dynamic evolution of local strains in the ANP during deformation. The video speed is accelerated five times.

Supplementary Movie 3: The dynamic evolution of local strains in the CNP during deformation. The video speed is accelerated five times.