Assessing strain rate sensitivity of nanotwinned Al-Zr alloys through nanoindentation

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Highlights

- Nanotwinned Al-Zr alloys reach 4.2 GPa nanoindentation hardness through column size restriction and high 9R phase content
- Nanotwinned Al-10Zr alloy reaches strain rate sensitivity of $m \sim 0.0297$, enhanced from the pure Al film ($m \sim 0.009$)
- Nanotwins proven to enhance strain rate sensitivity through the introduction of an abundance of mobile partial dislocations

Keywords

- Nanotwinned metals
- Strain rate sensitivity
- Nanoindentation
- Transmission Electron Microscopy
- Aluminum alloys

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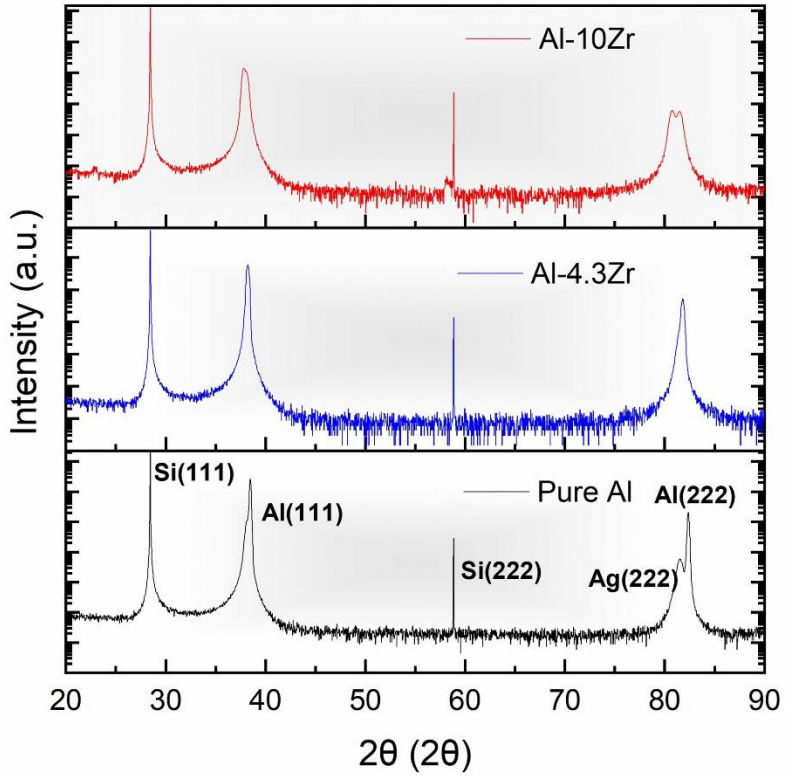
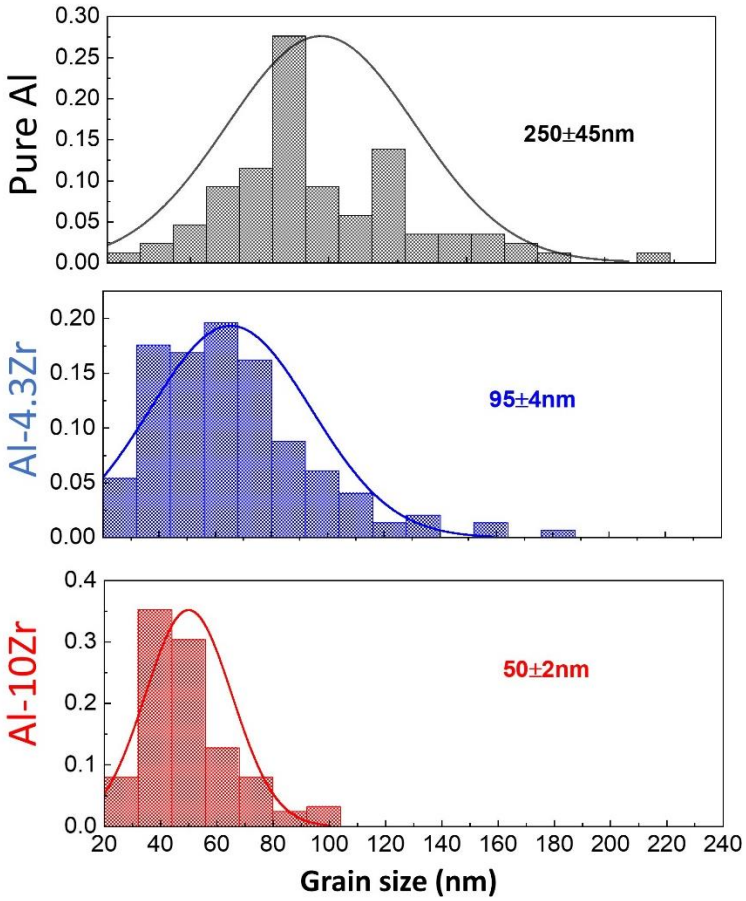
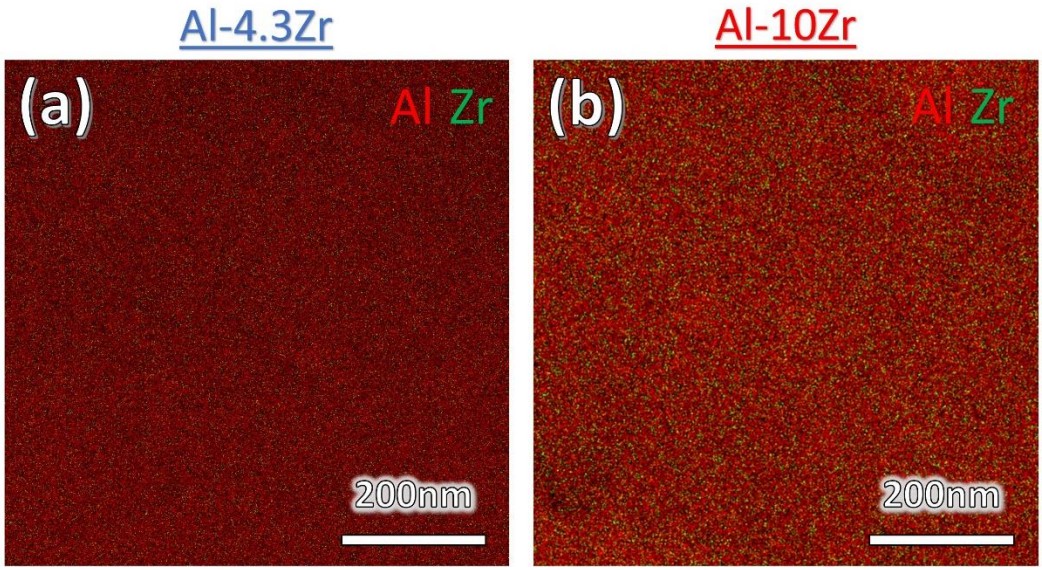
Supplementary Information



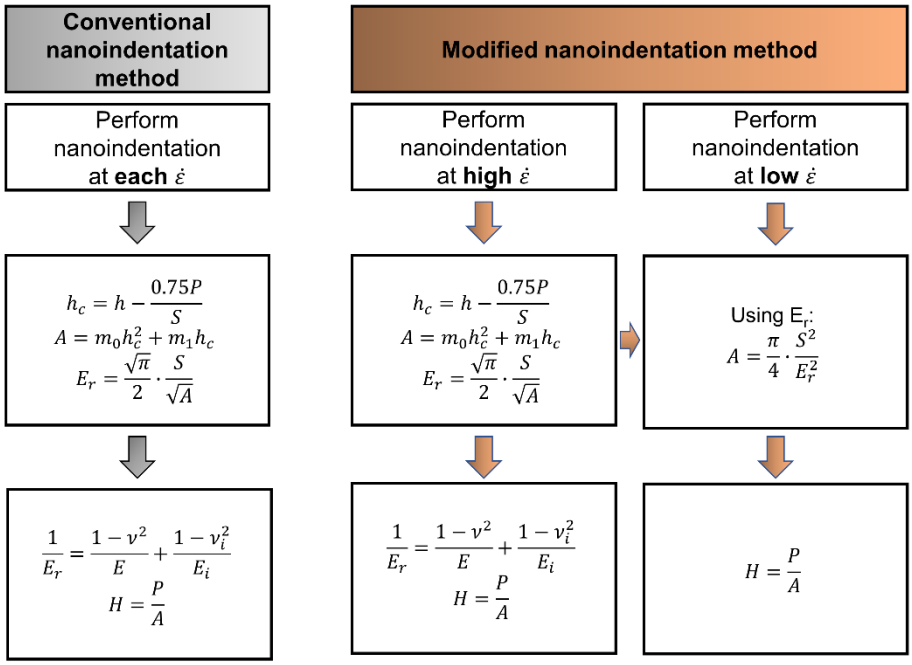
Supplementary Figure S1. XRD spectra revealing strong (111) texture in as-deposited films (Pure Al, Al-4.3Zr and Al-10Zr).



Supplementary Figure S2. Histograms showing grain size distribution for Pure Al, Al-4.3Zr and Al-10Zr.



Supplementary Figure S3. EDS maps of (a) Al-4.3Zr and (b) Al-10Zr demonstrating obvious solid solution and no segregation or phase separation.



Supplementary Figure S4. Flow chart detailing the differences between conventional and the modified nanoindentation method for measuring hardness at low strain rates.