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Anisotropic Damage Evolution in Aluminum Alloy 7075-T7351

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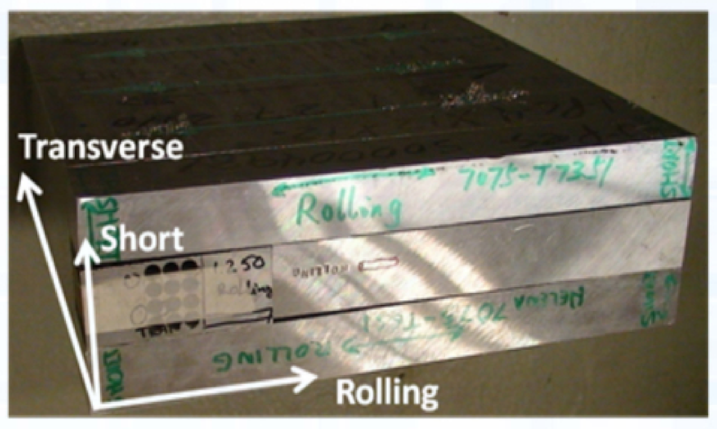
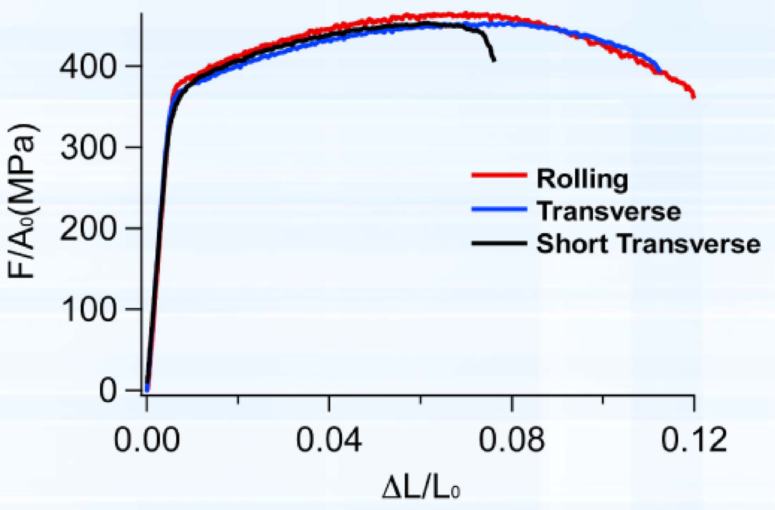
Motivation:

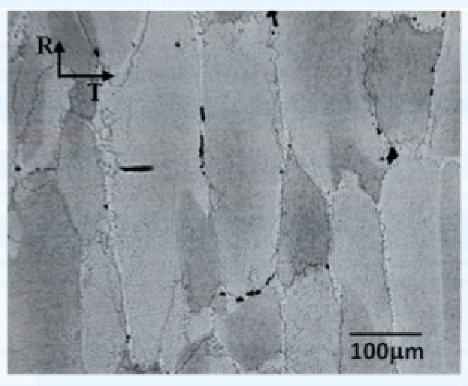
- **Anisotropic ductility is demonstrated by the stress-strain curves of three principal material orientations.**

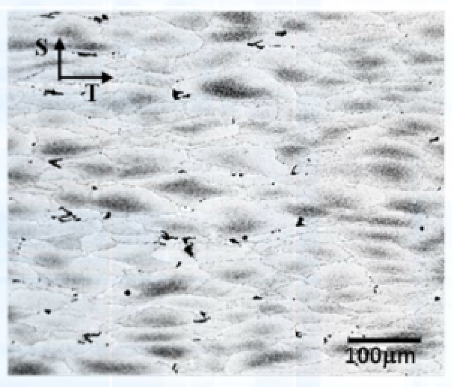




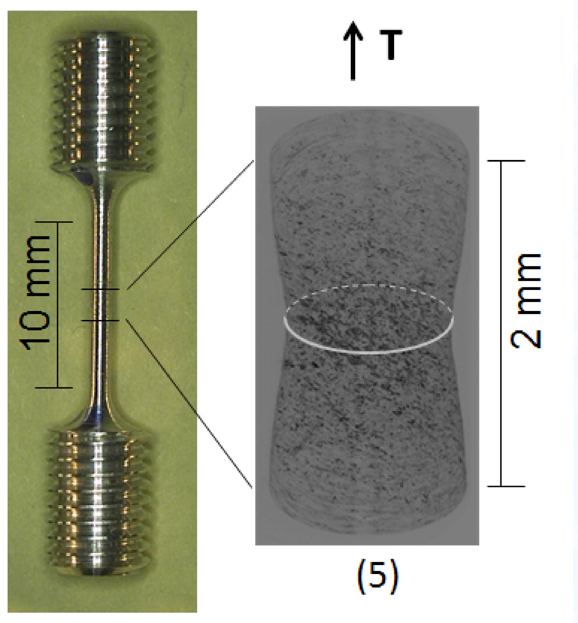
Experiment:

- **Optical micrographs of the material show grains are elongated.**

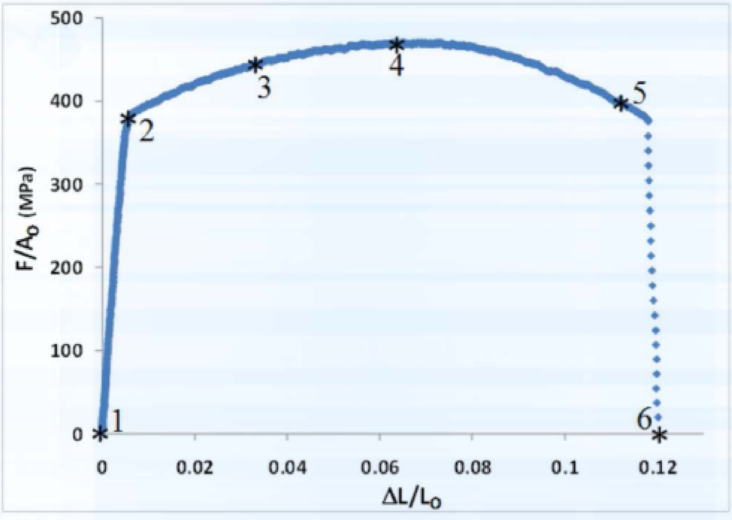


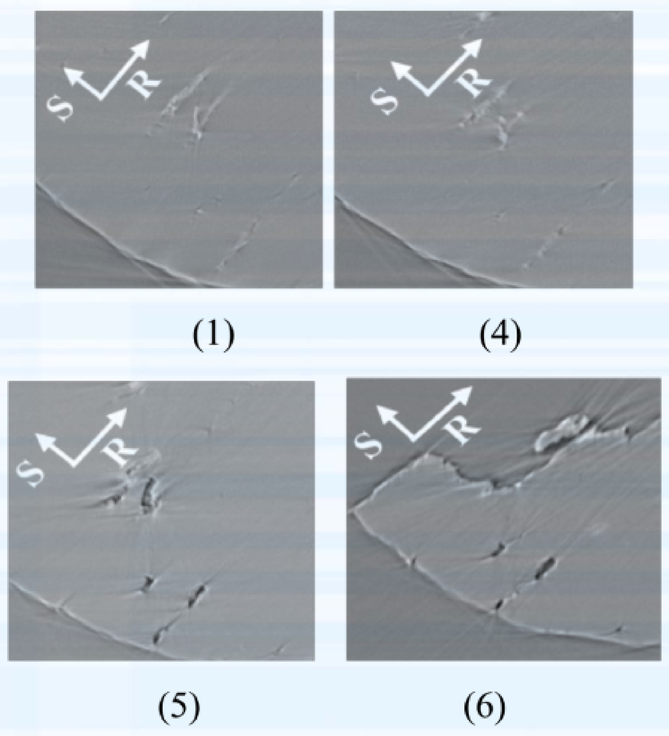


- **In-situ X-Ray CT enables us to observe damage evolution during tensile testing.**



(5)

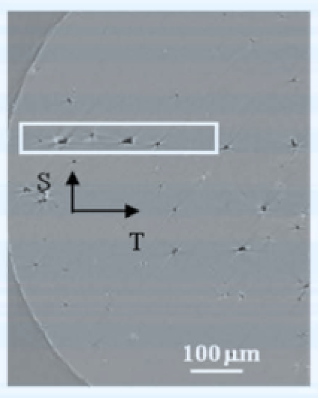


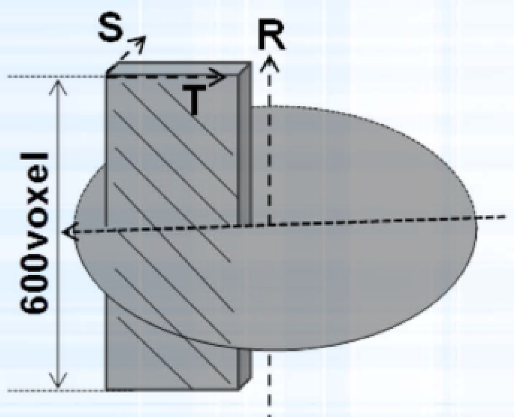


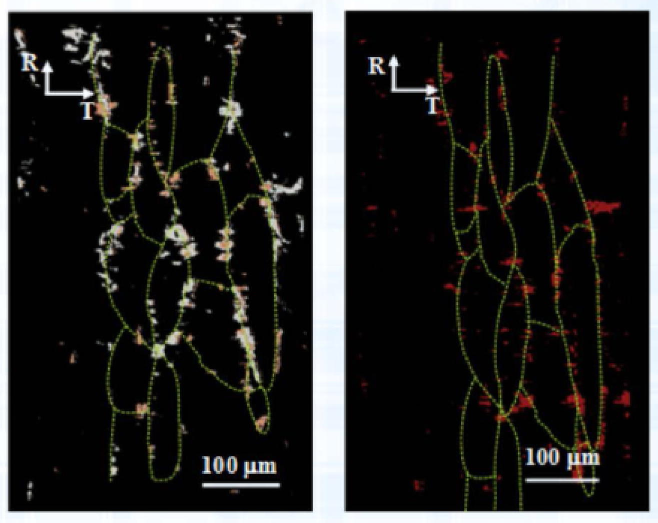
(1) (4) (5) (6)

Analysis of Tomography Data:

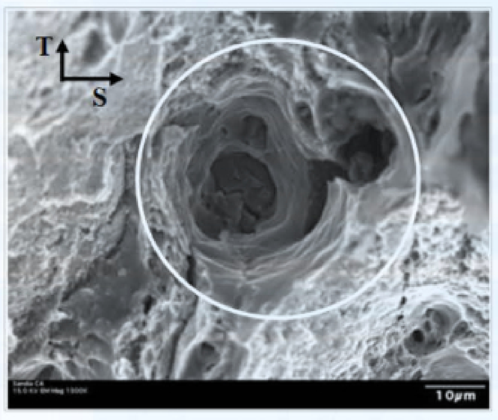
- **Loaded in rolling direction**





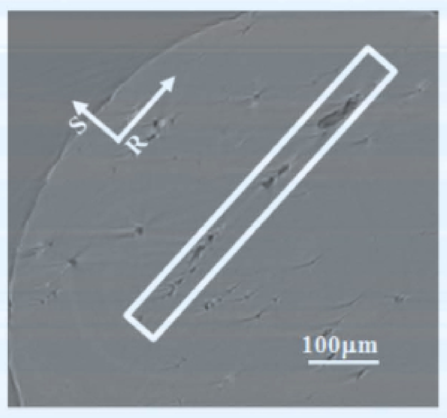


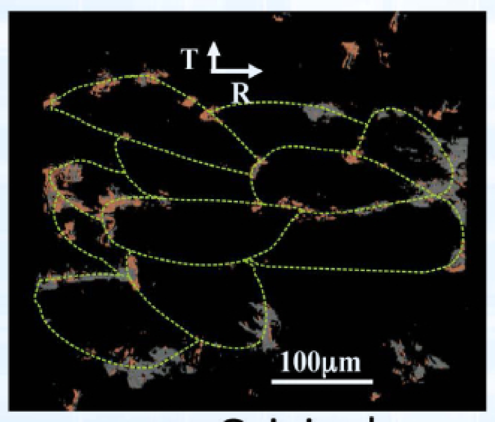
Original Near Failure



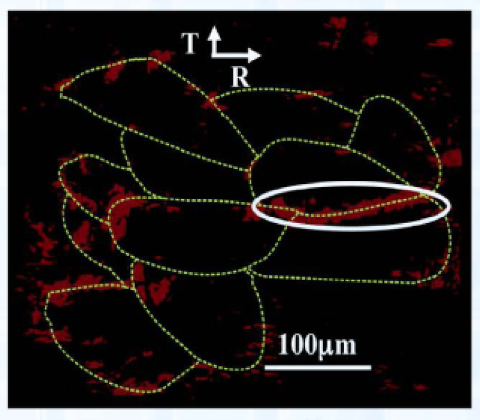
Failure

- **Loaded in transverse direction**

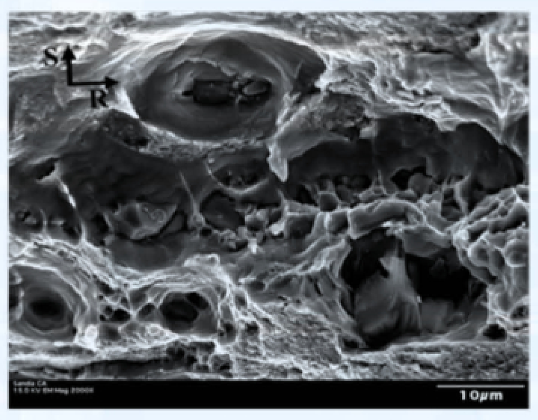




Original

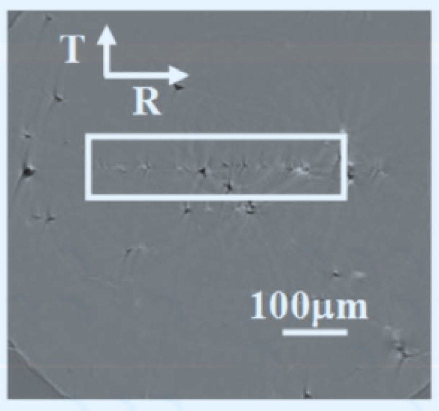


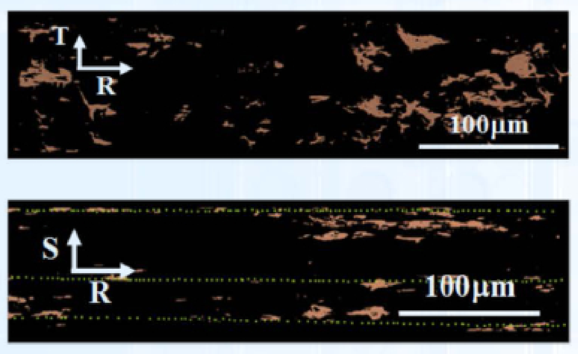
Near Failure



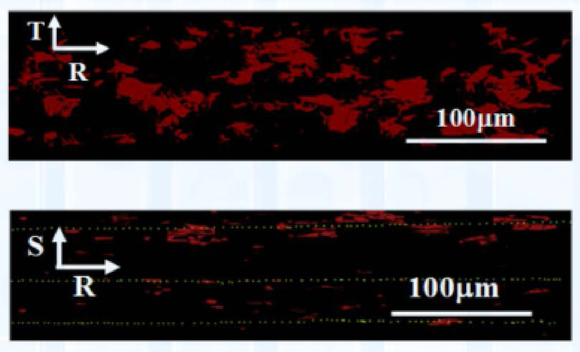
Failure

- **Loaded in short transverse direction**

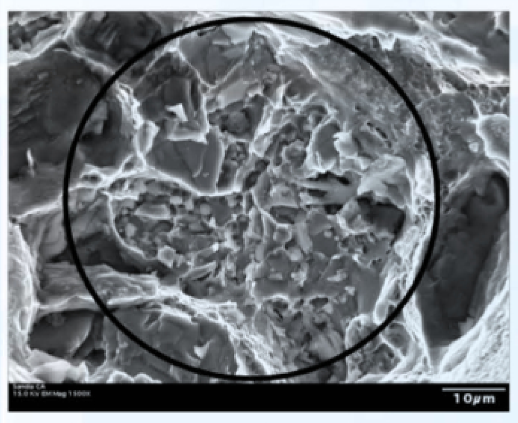




Original



Near Failure



Failure

Conclusions:

- *Voids were closely associated with particles and they were mostly distributed along the grain boundaries.*
- *The mechanism for the void growth and coalescence were different in three loading orientations.*
  - *For specimens loaded in the rolling direction, the void growth was nearly isotropic and there was no dramatic void coalescence in any direction.*
  - *For specimens loaded in the transverse direction, the void growth and coalescence had one-dimensional preference along "stringers" in the rolling direction.*
  - *For specimens loaded in the short transverse direction, the void growth and coalescence favored a pancake layout in the R-T plane.*

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