Title: "ADVANCED CHARACTERIZATION OF TWINS USING AUTOMATED EBSD."

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Advanced Characterization of Twins using Automated EBSD

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The poster describes results obtained using an automated, crystallography-based technique for twin identification. The technique is based on the automated EBSD. The key features of the analysis are identification of potential twin boundaries by their misorientation character, identification of the distinct boundary planes among the symmetrically equivalent candidates, and validation of these boundaries through comparison with the boundary and twin plane traces in the sample cross section. Results on the application of this technique to deformation twins in zirconium are analyzed for the effect of twin type and amount and sense of uniaxial deformation. The accumulation of strain tends to increase the misorientation deviation at least to the degree of the trace deviation compared with recrystallization twins in nickel.

Image quality map from nickel. The blue and red highlighted boundaries satisfy the twin misorientation relationship. The red boundaries have [111] bounding plane traces closely aligned with the boundary trace. The asterisk-like figures show the [111] plane traces.

Deformation Twins in Zirconium

Image quality maps from three zirconium samples with true strains of 4% in compression, 10% in compression and 16% in tension.

Deformation Twins in Nickel

Deviation distribution plot for recrystallized nickel

Comparing these results with the results from the deformed zirconium suggests that with deformation the twins tend to maintain the twin plane relationship more than the misorientation relationship.

References

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This poster describes results obtained using an automated, crystallographically-based technique for twin identification. The technique is based on the automated EBSD. The key features of the analysis are identification of potential twin boundaries by their misorientation character, identification of the distinct boundary planes among the symmetrically equivalent candidates, and validation of these boundaries through comparison with the boundary and twin plane traces in the sample cross section. Results on the application of this technique to deformation twins in zirconium are analyzed for the effect of twin type and amount and sense of uniaxial deformation. The accumulation of strain tends to increase the misorientation deviation at least to the degree of the trace deviation compared with recrystallized twins in nickel.

What can be measured from automated EBSD measurements on a single section plane?

- Orientations of Grains A & B (gA & gB)
- Misorientation between A & B (δg)
- Misorientation Deviation (δδg)
- Trace Deviation (δδt)

The trace deviations are measured using "reconstructed" boundaries instead of using the boundary segments which follow the measurement grid.

Deformation Twins in Zirconium

Image quality maps from three zirconium samples with true strains of 4% in compression, 10% in compression and 16% in tension.

Deviation distribution plots for deformed zirconium samples

<table>
<thead>
<tr>
<th>Sample</th>
<th>Misorientation Deviation Only</th>
<th>Misorientation and Trace Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>4% Compression</td>
<td>0.25</td>
<td>0.06</td>
</tr>
<tr>
<td>10% Compression</td>
<td>0.51</td>
<td>0.10</td>
</tr>
<tr>
<td>16% Compression</td>
<td>0.33</td>
<td>0.17</td>
</tr>
</tbody>
</table>

Twin fractions in zirconium calculated with and without the trace deviation analysis. A tolerance of 10° was allowed for both deviation parameters.

References