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

Author(s): Stuart I Wright, EDAX/TSL, INC
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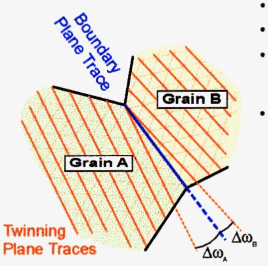
Advanced Characterization of Twins using Automated EBSD

Stuart I. Wright[1], John Bingert[2], Thomas A. Mason[3] and Ryan J. Larsen[4]

1 EDX/TSL, Draper, Utah USA; 2 Naval Research Lab, Washington DC USA; 3 Los Alamos National Laboratory, Los Alamos, New Mexico USA; 4 Brigham Young University, Provo, Utah USA

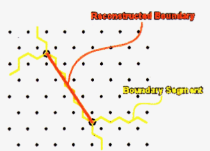
This poster describes results obtained using an automated, crystallographically-based technique for twin identification. The technique is based on the automated EBSD. The key features of the analysis are identification of potential twin boundaries by their misorientation character, identification of 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 recrystallization twins in nickel.

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



- Orientations of Grains A & B (g_A & g_B)
- Misorientation between A & B (Δg)
- Misorientation Deviation ($\Delta\theta$):
  Deviation between AB Misorientation & Ideal Twin Misorientation Relationship
- Trace Deviation ($\Delta\omega = (\Delta\omega_A + \Delta\omega_B)/2$)

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



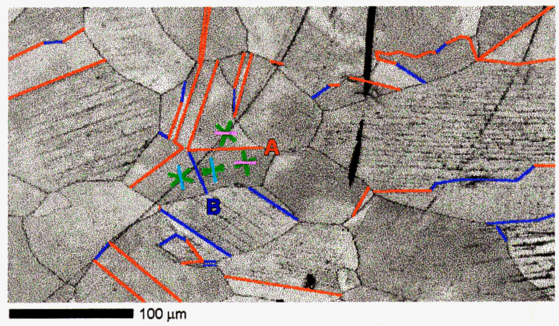


Image quality map from nickel. The blue and red highlighted boundaries satisfy the twin misorientation relationship. The red boundaries have {111} twinning plane traces closely aligned with the boundary trace. The asterisk-like figures show the {111} plane traces.

Deformation Twins in Zirconium

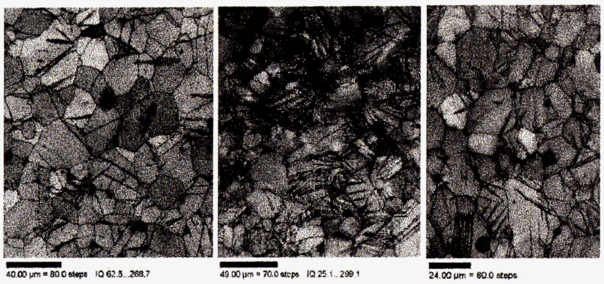
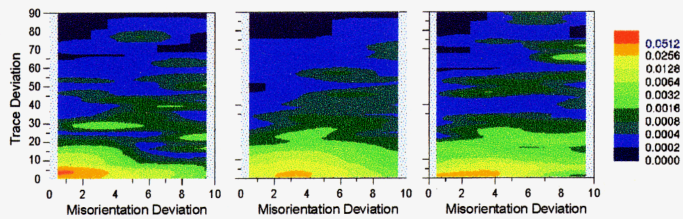


Image quality maps from three zirconium samples with true strains of 4% in compression, 10% in compression and 16% in tension.

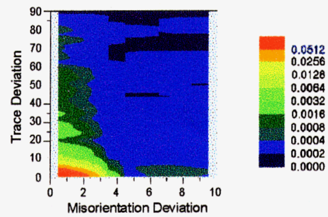


Deviation distribution plots for deformed zirconium samples

Sample	Misorientation Deviation Only	Misorientation and Trace Deviation
4% Compression	0.25	0.06
10% Compression	0.51	0.10
16% Compression	0.33	0.17

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

Recrystallization 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

[1] B.L. Adams, S.I. Wright and K. Kunze: *Met. Trans.* Vol. 24A (1993), p. 819.
[2] T. Watanabe: *Grain Boundary Architecture for High Performance Materials* (Eds. R. C. Pond, W. A. T. Clark and A. H. King, The Minerals, Metals and Materials Society, Warrendale, Pennsylvania 1998), p. 19.
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[5] Y. Pan, B.L. Adams, T. Olson and N. Panayotou: *Acta Mat.* Vol. 44 (1996), p. 4685.
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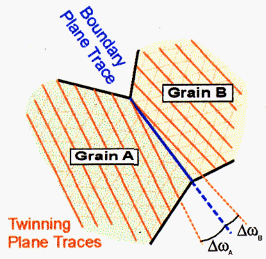

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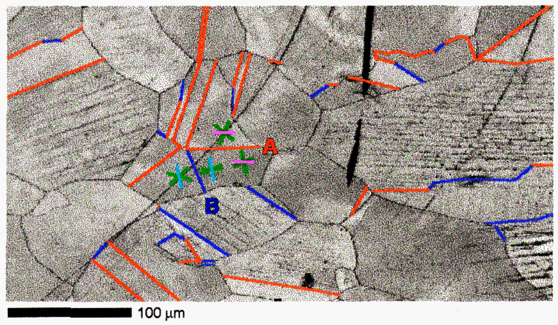

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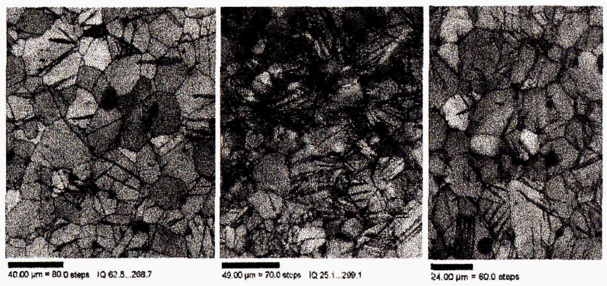

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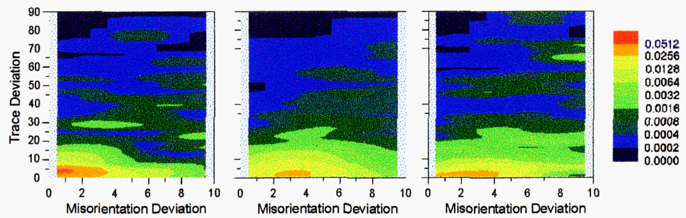

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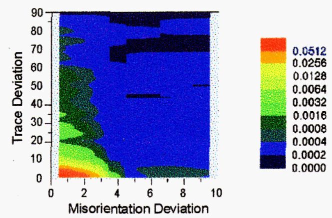

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