4. J. ASTM STP 1132 p. 80, 1990.

Texture Analysis expensive → qualify process

CSR ⇒ tensile test, 4% plastic defor. axially, grid on specimen, measure axial + diam. change

CSR vs texture: there is correlation

Teleconference Call Summary

R.L. Kesterson, Materials Fuel Rod Design for the Commercial Nuclear Fuel Division, Westinghouse Electric Company.

Tuesday, 11/2/99, 3:00 pm

only for new process

to show mat'l meets specs.

(*) mech. prop. tests always done on lots of tubes → 600 tubes
1 CSR + 1 tensile test axial at R

(*) process monitoring function.

Can speak for WE, only

1. How do fuel cladding manufacturers use texture analyses to qualify the material?

- No spec. for texture req., Kearn's #'s ⇒ bkg check, pole figs

a. Do they use the analyses to validate that the material has certain minimum mechanical properties?

CSR ⇒ does correlate w/ RD + Circ. texture ⇒ in ASTM spec.
f-factor back up.

* UTS, YS not effected by normal range in CSR
⇒ has to be w/i certain range CSR = 1.2 - 2.25

b. Or, do they use the analyses to verify the fabrication processes were done correctly?

Q-factor ⇒ ratio nat log wall / final wall
nat log mid wall / final mid wall

* For control of manufacturing process

* High Q ⇒ high fR #
Low Q ⇒ high fHoop #

pole figs for characterization - only for different design or manufacture process, change indices for forming

c. What are the acceptance criteria for the texture analyses?

w/ CSR ⇒ last 3 stage det. texture of end product.

2. Can the results from texture analysis be used to qualify substandard material? For example, can substandard material be found acceptable: if out in tensile test range → wouldn't use texture

hydride, corrosion

tex. analysis ⇒ not used independently from other tests

• Cannot falsely identify material

Flare test (other manufacturers): take cone shaped object in end before cracking... measure circum. + radial

a. from partial direct pole figures (i.e., φ>60°, the specimen tilt angle measured from the surface normal)

width of peak is important. — don't worry a lot of it in hoop

b. even though the maximum intensity, I_{max}, and the location of the basal plane maxima, φ_{RD}, on a RD-TD (i.e, radial direction-transverse direction) direct pole figure are within the ±30-35° expected ranges

(•) poor sample prep.

direct pole fig ⇒ Lambda research
↳ 1 sample, 3 direction measurements

3. What effect does obtaining data from the shoulder of a 2-theta peak (i.e., 0.5° away from the maximum intensity) have on a direct pole figure? ⇒ don't know width

* flatter peaks ⇒ more pole in hoop direction more prone to PCI
want split
* want FWHM

Kearn's # ≤ 1.0

4. Regarding direct pole figures, what would be an acceptable variation in peak intensity (at 2-theta) and location of the basal plane maxima from one sample to another?

±30-35°

Don't know.

→ 6-7 times random from some data/paper for 30-35° peaks

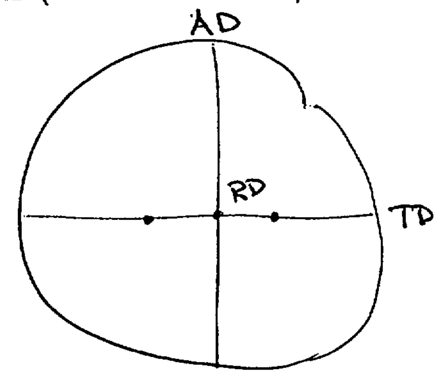
→ flatter peak ⇒ 3 x random

A/B

not big deal ⇒ ask about texture through thickness of cladding ⇒ thin wall to mid-plane ⇒ con that measurement

5. Have you ever seen pole figure data where the basal planes (i.e., the (0002) planes) are positioned ±35° from the longitudinal direction of a tube specimen on a RD-TD direct pole figure? How would the mechanical properties of cladding with this type of texture differ from cladding material with a basal pole maxima located ±35° from the RD (on a LD-TD direct pole figure)?

90° rotation problem
↳ Seen texture bad
I's near 90°
Some where peaks off E-W line



(0002)
⇓

(*) mech. prop.
- axial tensile test properties
Same values regardless of radial
or hoop ⇒ axial properties

- biaxial test would see differences
↳ circumferential properties

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texture analysis for verification or
validation that process is still good?
WE wouldn't do it ⇒ uses CSR
If no CSR, want some way to periodically
monitor material (burst, flare test)
not want to send samples frequently →
strong confidence that die is same
day after day