



OFFICE OF NUCLEAR REGULATORY RESEARCH

LOCA Ductility Tests

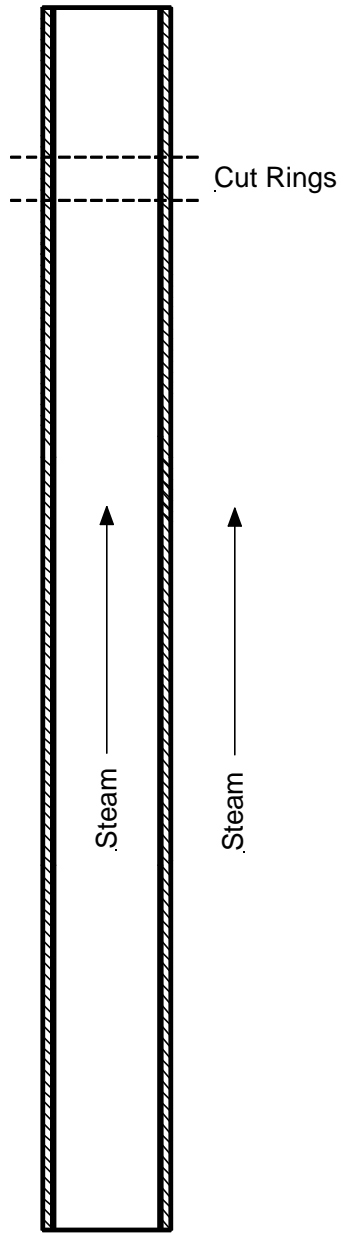
Ralph Meyer

with illustrations by Nicolas Waeckel, EdF

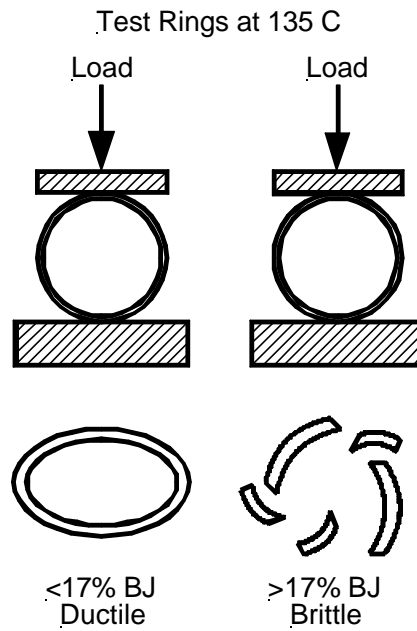
Ring-Compression Tests



Ring Tests

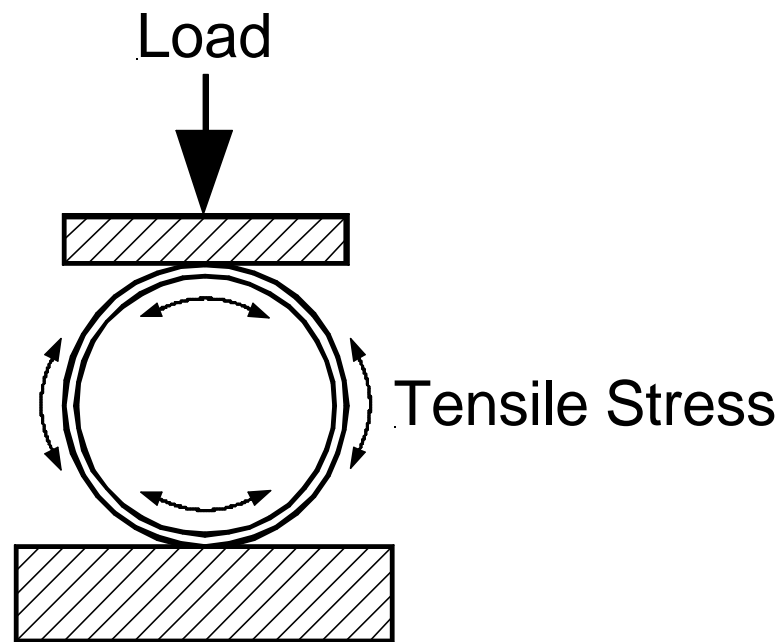


Oxidize at 1000 - 1200 C

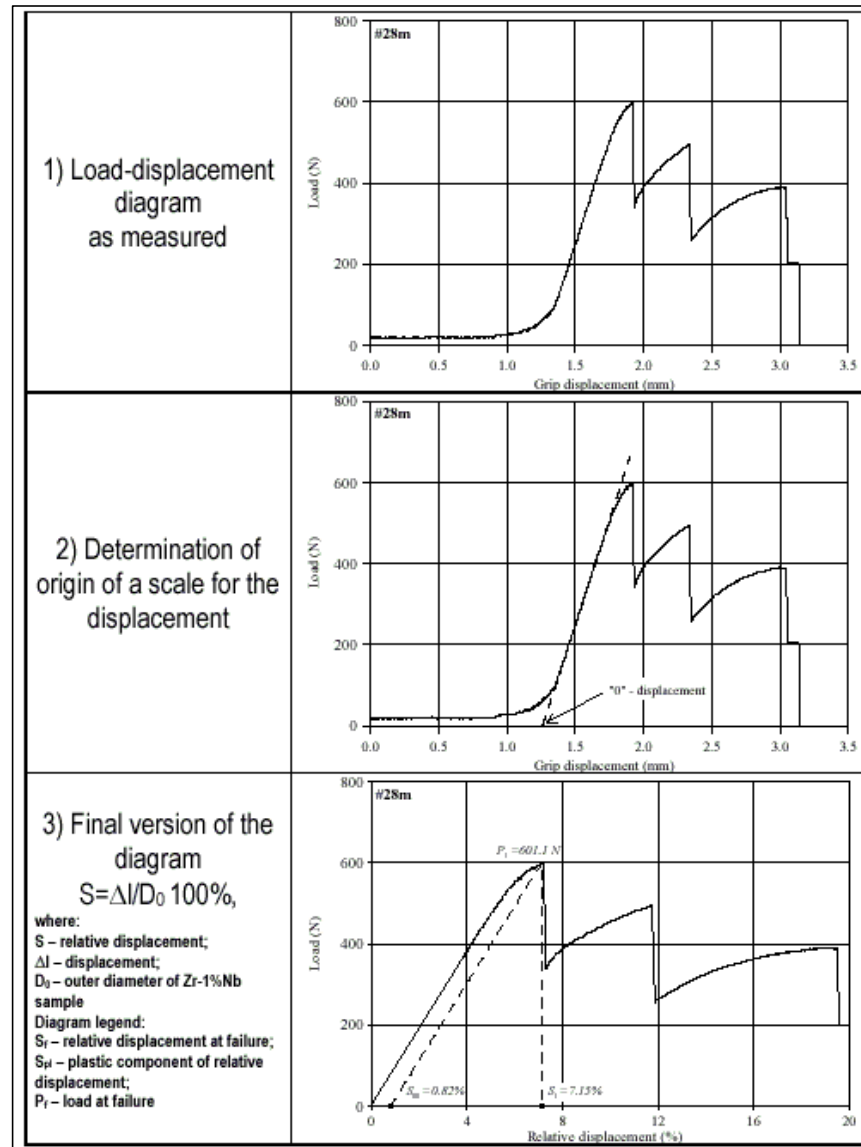


BJ = Total Oxidation Calculated with
Baker-Just Correlation

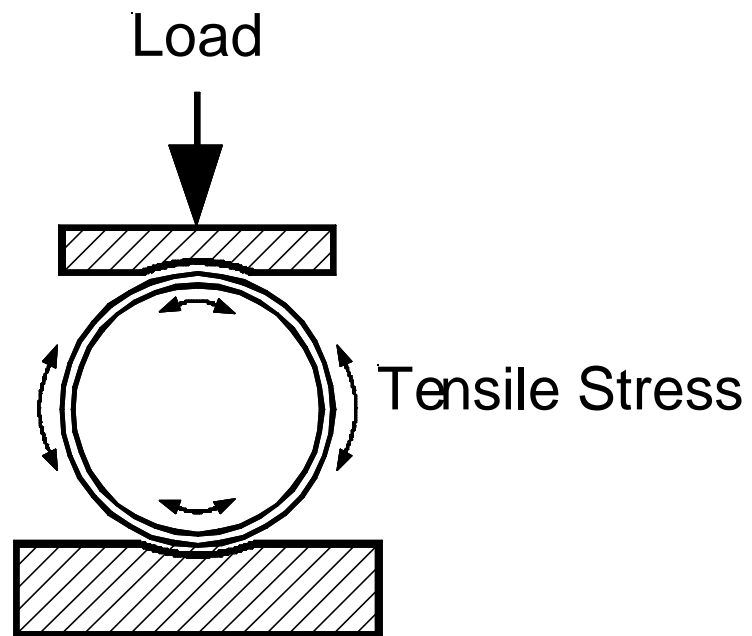
Large OD and ID tensile stresses in ring between flat plates



Load-vs-displacement curve for ring-compression tests showing Kurchatov method of analyzing results



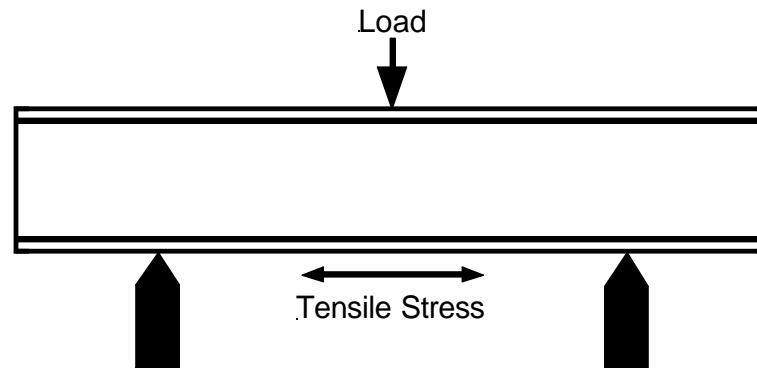
Smaller ID tensile stresses in ring between curved plates



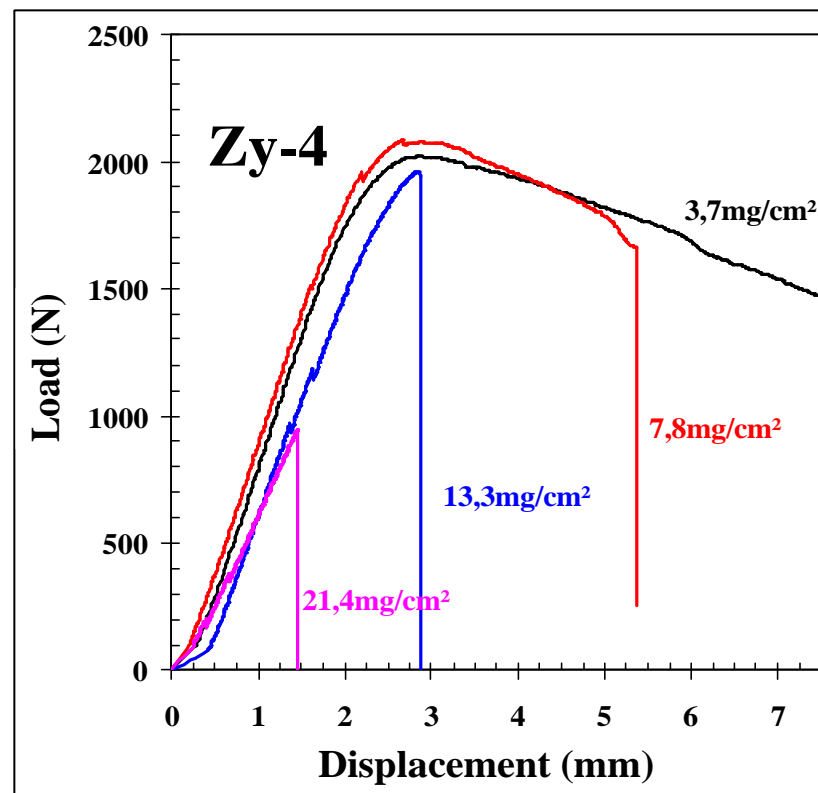
Three-Point Bend Tests



Three-point bend test with tensile stress on lower OD surface



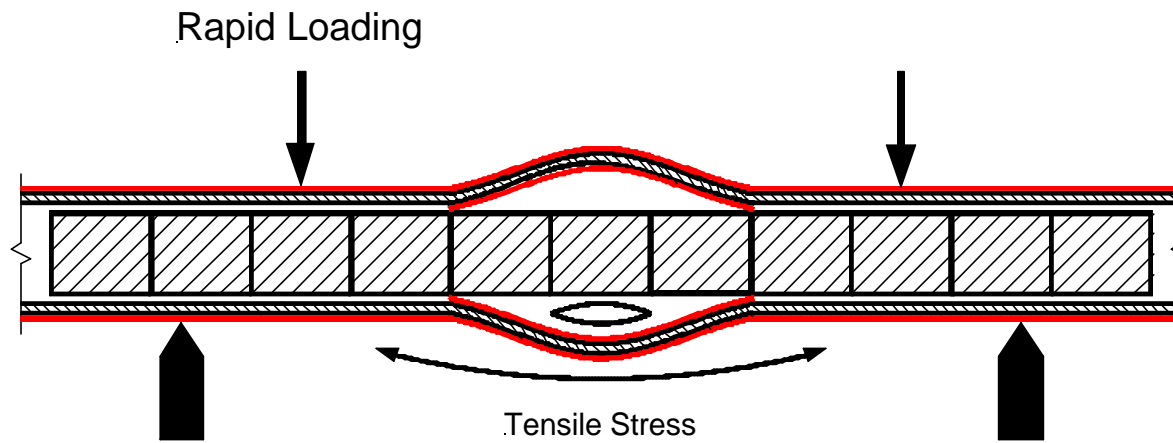
Load-vs-displacement curve for four Framatome three-point bend tests



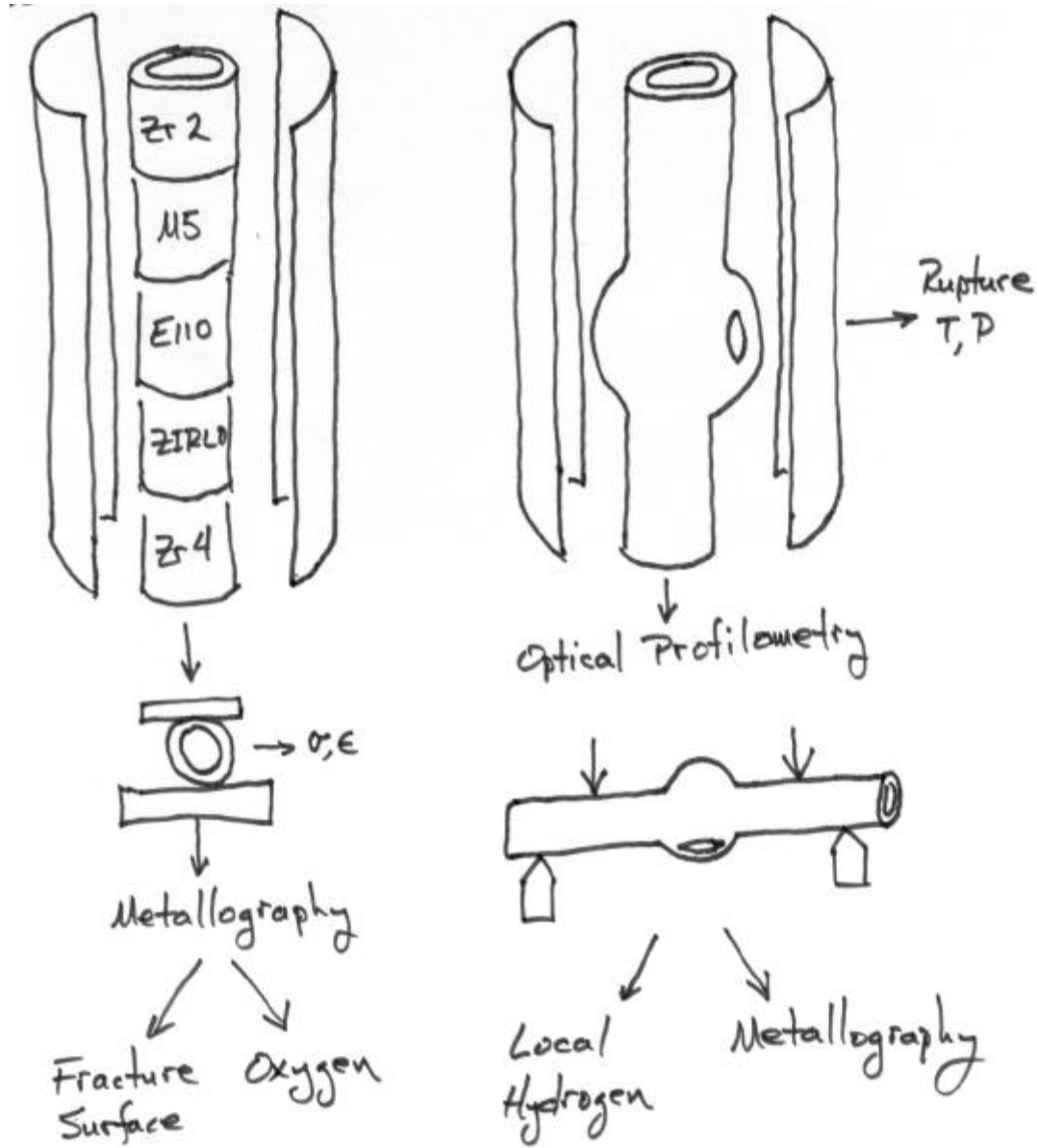
Four-Point Bend Tests



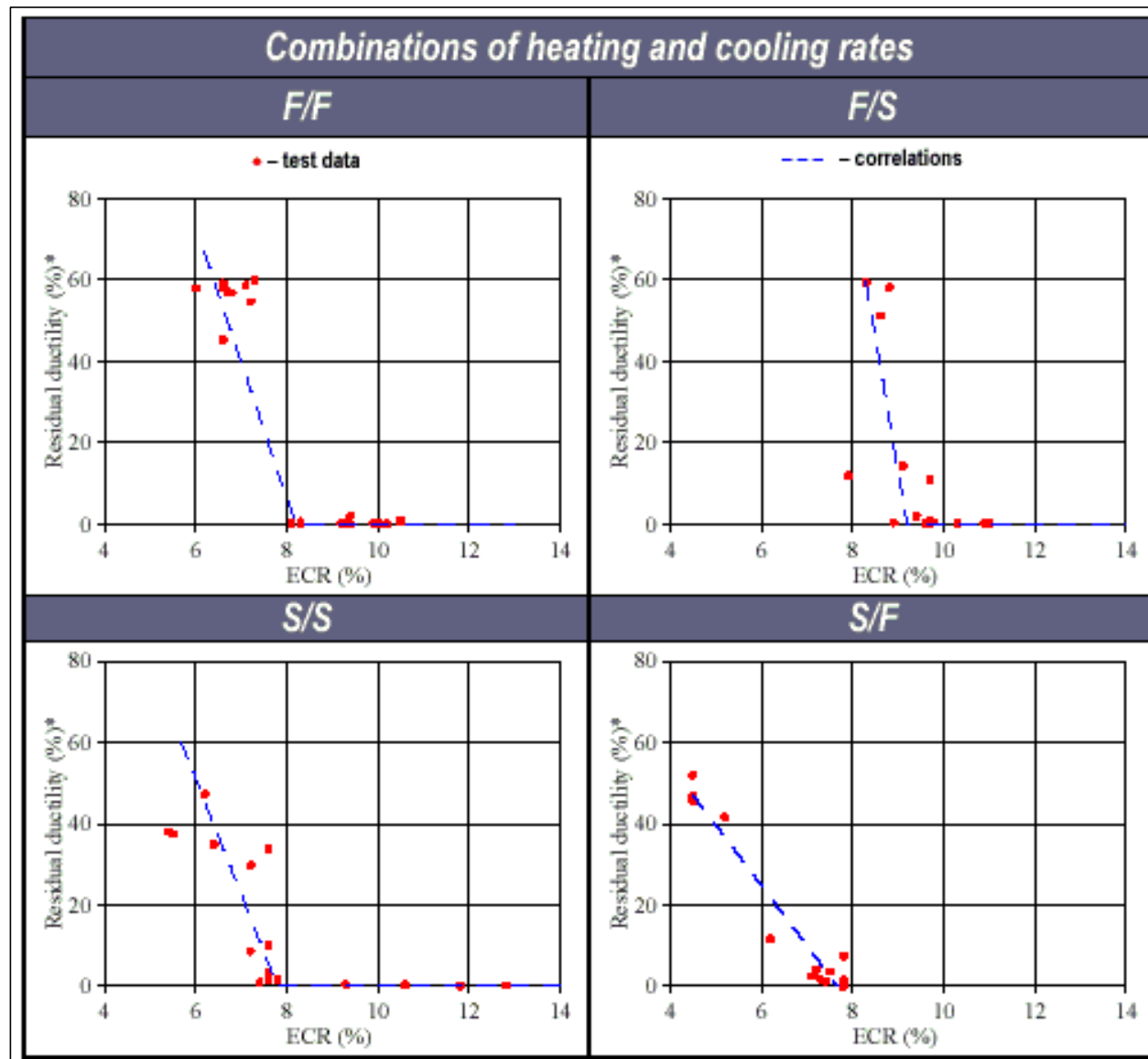
Four-point bend test on ballooned and ruptured segment of rod containing fuel; tensile stress on lower OD surface



Schematic diagram of testing sequence



Residual ductility versus oxidation for four Kurchatov combinations of heating rates



SUMMARY

- Preparations for ring-compression testing are underway
- Zircaloy-2, Zircaloy-4, M5, and E110 tubing are at Argonne
- Negotiations are underway with Westinghouse for ZIRLO tubing
- Unirradiated tests and assessment of results to be completed by December 2003