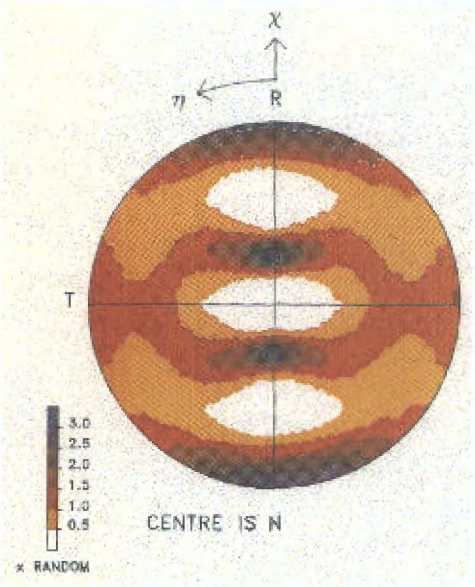
Analysis of Texture

The preferred orientations of crystallites in industrial materials can influence the properties of manufactured objects, adding a directional dependence to such quantities as corrosion resistance, yield strength, creep resistance, elastic stiffness and thermal expansion. Neutron diffraction averages over the bulk of a specimen to obtain a quantitative analysis of the distribution of crystallite orientations, also called the crystallographic texture. Texture is a key measurement for evaluating the effects of process parameters on industrial materials, such as rolled plates, extruded tubes and forgings.



Volume-fraction Analysis

Complete neutron diffraction patterns are analyzed to determine the volume fractions of components in composite materials, such as graded ceramics, metal-matrix composites and precipitates in alloys. Volume fractions as low as 0.5% can be evaluated quantitatively. Data can be acquired as a volume-average of bulk material, or as a non-destructive spatial scan of the interior of a component. Volume fraction data serve as indicators of process-control. This analysis method can be exploited to monitor precipitation, reactions and phase transformations at realistic material-processing temperatures.

New Techniques

The versatile nature of neutron diffraction makes it an ideal tool to undertake novel inquiries into industrial issues. Developing techniques include non-invasive thermometry, real-time tracking of oxidation, monitoring of electrochemical reactions, and large-volume-scanning of microstructural homogeneity.

Texture is determined from the variation of diffracted neutron intensity versus direction in material, plotted here as a stereographic pole figure.

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- Shipping and Rail
- Oil and Gas
- Nuclear
- Pressure Vessels
- Piping
- Steel
- Aluminum
- Advanced Alloys
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For more information or to arrange measurements contact Dr. John Root:
National Research Council Canada
Steacie Institute for Molecular Sciences
Neutron Program for Materials Research
Chalk River Laboratories
Chalk River, Ontario
Canada, K0J 1J0

Phone: 613-584-8811, Ext. 3974
1-888-243-ANDI
FAX: 613-584-4040
E-mail: NPMR@nrc.ca
WWW: http://neutron.nrc.ca