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SICHERHEITSANALYSE VON REAKTORDRUCKBEHÄLTERN

G. BARTHOLOMÉ, H. DORNER,

Siemens AG, Reaktortechnik, Erlangen, Germany

An evaluation of the safety of nuclear reactor pressure vessels for pressurized water reactors to resist fracture is an important feature in ensuring nuclear reactor safety. This evaluation is performed using fracture mechanics.

Basic theory of fracture mechanics
The linear, elastic and plastic stress distributions for plane stress and plane strain conditions are derived for the different modes of fracture. The concepts of the linear elastic fracture mechanics and of the crack-opening method are shown. A critical analysis of crack growth and of stress corrosion cracking extends the use of fracture mechanics.

Technical application of fracture mechanics on nuclear reactor pressure vessel:
- Design and calculation of reactor pressure vessels using brittle fracture concepts,
- estimation of permissible crack sizes for the specification of standards for inspection, hydrostatic pressure test and recurring inspections,
- evaluation of the operating performance and life expectancy of nuclear reactor pressure vessels including crack growth and stress corrosion cracking.

Safety evaluation
Using the above derived data, the safety of reactor pressure vessels against fracture is shown by means of:

- Crack size - stress diagrams,
- brittle fracture diagrams and ductile fracture diagrams,
- operating stress diagrams.

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