

## Degradation of Zr Alloys

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### Practice Questions

Please try to answer these questions. We will cover the answers to these questions, and others, in the “live” lecture.

1. The following questions are related to the oxide growth and periodic corrosion of Zr alloys;
  - i. What two types of grains are usually seen in the oxide microstructure in Zr alloys?
  - ii. What two phases is this oxide usually composed of?
  - iii. Which of the oxide phases in question (ii) is “stress-stabilised”?
  - iv. What other *two* properties help to stabilise the oxide phase identified above, in question (iii)?
  - v. Describe the stress distribution in the oxide, from the metal-oxide interface to the oxide-coolant interface.
  - vi. Describe what happens to the nano-porosity in the oxide at the transition stage.
  - vii. Using the answers above, describe the process of oxide growth in Zr alloys and how the oxide microstructure might transition from stable/protective to unstable/unprotective, leading to periodic corrosion of the Zr metal.
  - viii. What role does Sn play in the oxide microstructure, and how does this affect the transitions in the oxide?
  - ix. What effect does neutron irradiation (in-reactor) have on corrosion processes?
2. The Pellet Cladding Interaction (PCI) is a particular problem for nuclear power plants that power maneuver or load follow – *continually increasing/decreasing power output to match the demands of the power grid*. From your knowledge of the PCI mechanism describe why power maneuvering (or load following) might increase the likelihood of PCI failures in the Zr cladding.