CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

From the characterization of oxide films grown on Ni-based alloys, 304 stainless steel and Zirc-4 in simulated PWR primary coolant, the following conclusions are obtained:

- The oxides formed on Ni-based alloys and SS304 were duplex layers consisting of an Fe-rich crystallite layer and a Cr-rich underlying layer, while the oxide formed on Zirc-4 was a single layer of ZrO_2.
- The higher-Cr alloys apparently produced a more protective oxide than the lower-Cr alloys.
- The effect of heat treatment was observed on Ni-based alloys, but it was overshadowed by effects of alloy composition.
- The oxides formed in the coolant containing both boron and lithium were more compact and protective than those in the coolant without boron.
- Zn addition enhanced the formation of protective oxide on Ni-based alloys and on SS304, but not on Zirc-4.
- More dissolved ions in the coolant resulted in higher oxide growth.
- The crystallite size and coverage on Ni-based alloys and SS304 increased with increasing time.
- The higher coolant temperature resulted in a higher corrosion rate.

5.2 Recommendations

- The oxides on all samples in this work were analysed with SEM and EDX to examine the effect of SG alloy composition and heat treatment, boron concentration and Zn addition on oxide film formation, while the oxides on some samples were analysed with SIMS and XPS to determine the oxide thicknesses and

the oxide phases. It would be interesting to characterize the oxides on all samples with SIMS and XPS for confirmation of those effects.

- Two different Zn concentrations, exposure times and coolant temperatures were studied in this work. To see the complete effects of Zn addition, exposure time and coolant temperature on oxide film formation, various Zn concentrations, exposure times and coolant temperatures in the experiment should be investigated.
- The effect of heat transfer on oxide film formation would be interesting to be investigated by various the heat fluxes through the sample surfaces.
- To attempt to eliminate the Zn contamination from the lubricant, other Zn-free lubricants are needed.
- Corrosion rates of SG alloy and SS304 samples would be interesting to be determined.