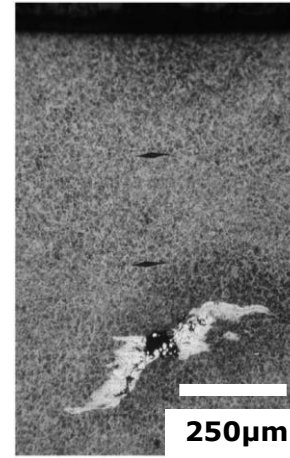


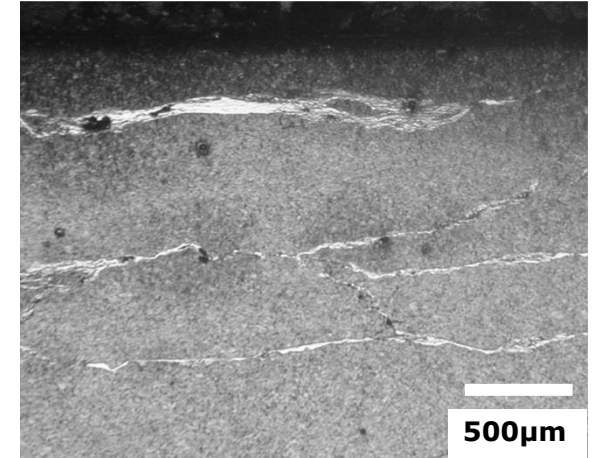
Wind turbine gearbox bearing failures

White structure flaking: causes 60-85% of gearbox bearing failures

- Butterflies & white etching cracks (WEC) propagate subsurface causing spalling.
- Occur at depth of >1mm below contact.
- Slip and hydrogen are quoted drivers.
- Formation of WEC is not well understood.
- A two roller rolling contact fatigue machine is being used to replicate WEC in lab.

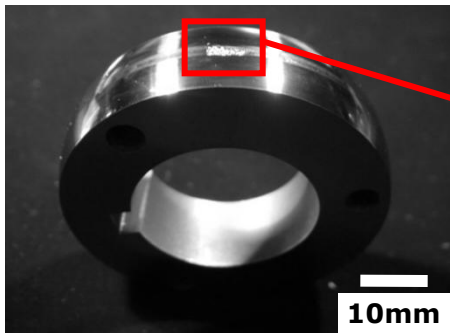


Butterfly

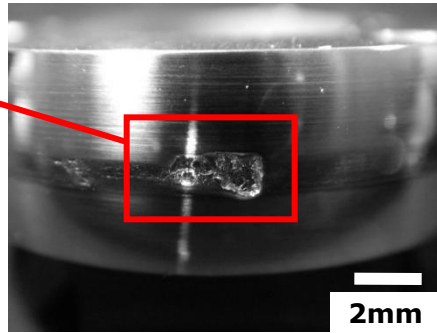


White etching crack network

Lab test rollers showing spalling failure



Spall on wear track



Zoom of spall

Results and future work

- Tribological test conditions which drive white structure formation are being systematically investigated in laboratory.
- Spalling failure can be produced in laboratory using transient test conditions.
- Metallography is being conducted to determine if spalls are caused by WEC.
- Novel materials and oils are being investigated as potential solutions to WEC.