MID thema-avond

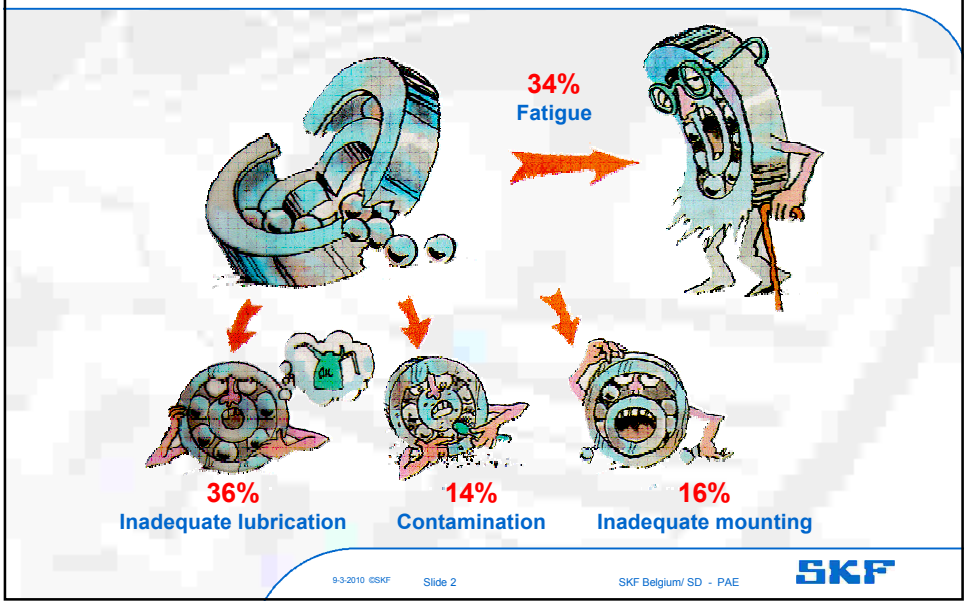
Lagerschaden en hun oorzaken

SKF Belgium

Application Engineering / Serge Herman

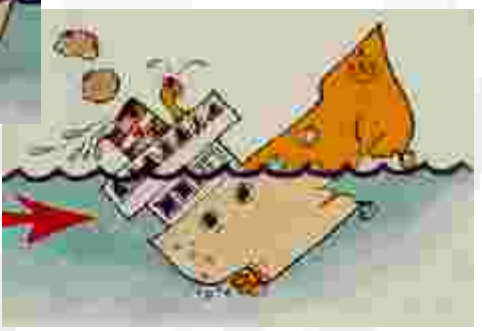
08/03/2010

General statistics - Failure's reasons



General statistics - Standstill's cost

Primary cause



Secondary cause(s)

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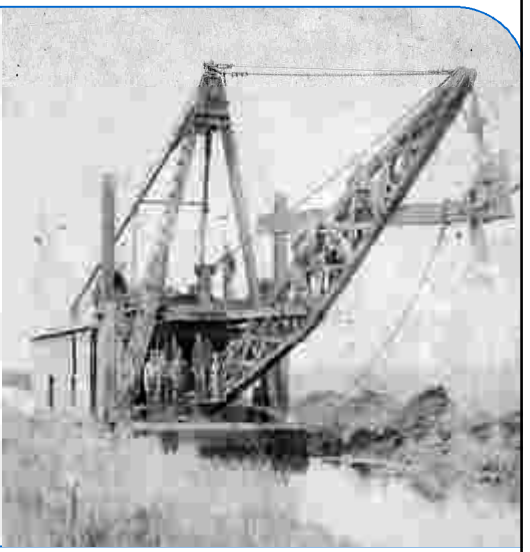
Typical running conditions for dredging boats

Some typical running conditions:

- Slow or moderate rotating speeds
- Potential water and/or contamination ingress
- High loads
- High vibrations of the structure



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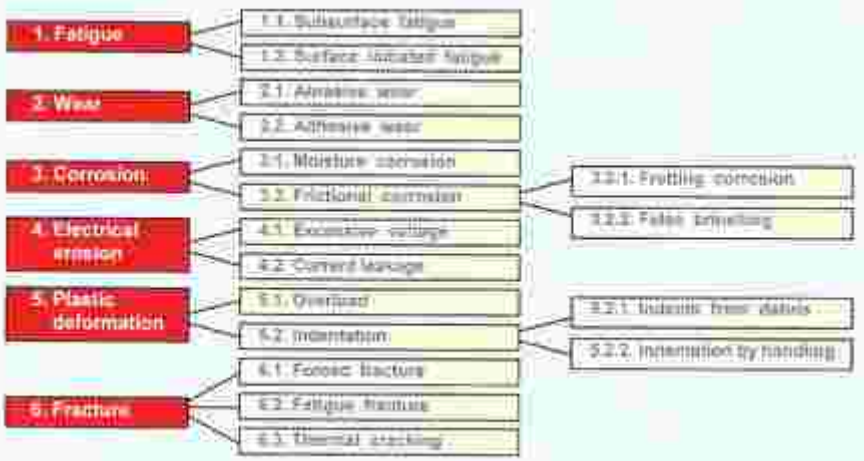
ISO failure mode classification (ISO 15243: 2004)



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Fatigue / Subsurface

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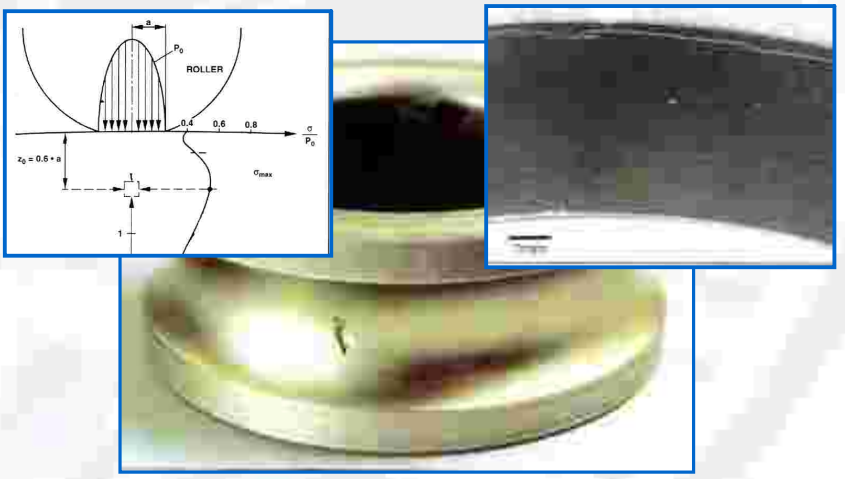
Fatigue / Subsurface (normal fatigue)



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Fatigue / Surface intiated

1. Fatigue
   - 1.1. Subsurface fatigue
   - 1.2. Surface initiated fatigue
2. Wear
3. Corrosion
4. Electrical erosion
5. Plastic deformation
6. Fracture

- surface distress
- reduced lubrication regime
- sliding motion
- burnishing, glazing
- asperity micro-cracks
- asperity micro-spalls

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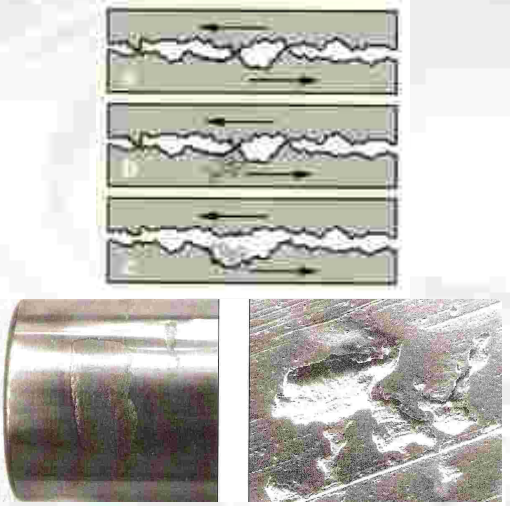
Fatigue / Surface intiated

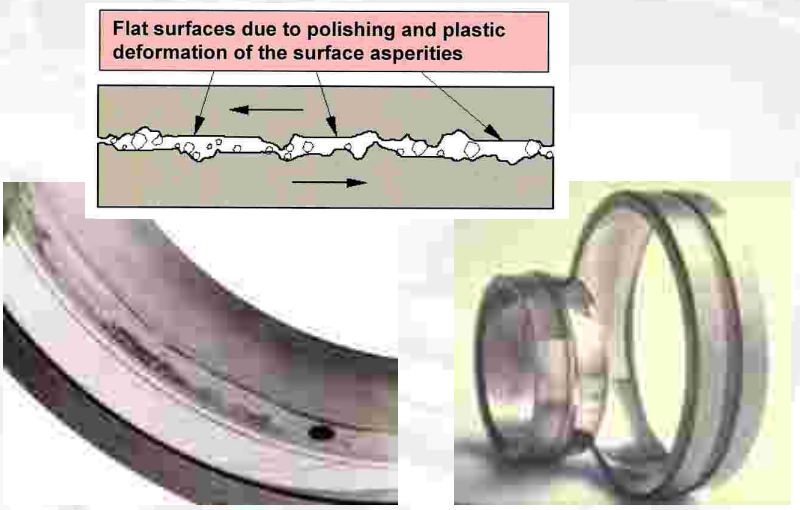


Wear / Abrasive wear

1. Fatigue
2. Wear
   - 2.1. Abrasive wear
   - 2.2 Adhesive wear
3. Corrosion
4. Electrical erosion
5. Plastic deformation
6. Fracture

- progressive removal of material
- inadequate lubrication
- ingress of dirt particles
- dull surfaces (mostly)
- accelerating process

Wear / Abrasive wear



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Wear / Adhesive wear

1. Fatigue
2. Wear
   - 2.1. Abrasive wear
   - 2.2. Adhesive wear
3. Corrosion
4. Electrical erosion
5. Plastic deformation
6. Fracture

- accelerations
- smearing / skidding / galling
- material transfer / friction heat
- tempering / rehardening with stress concentrations and cracking or flaking
- low loads

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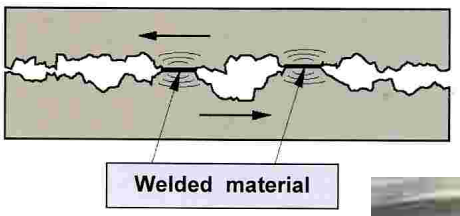
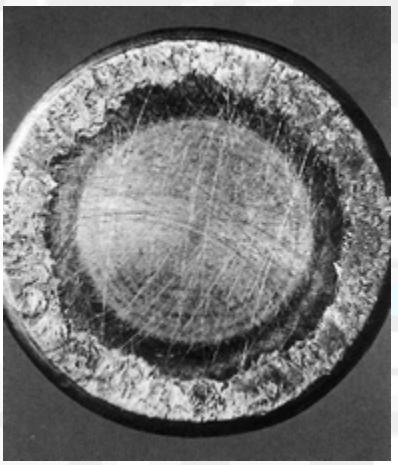
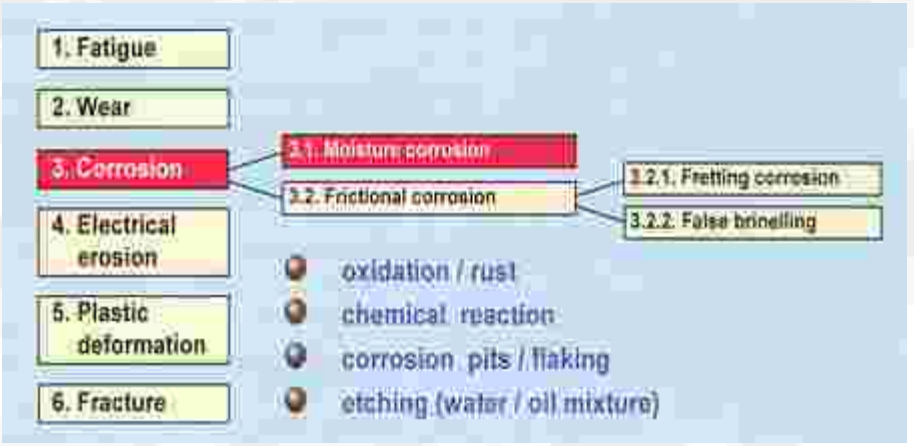
Wear / Adhesive wear



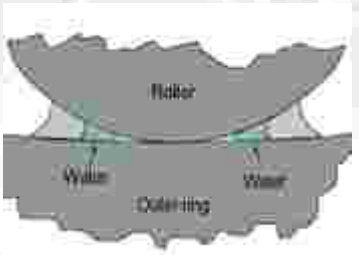
Wear / Adhesive wear

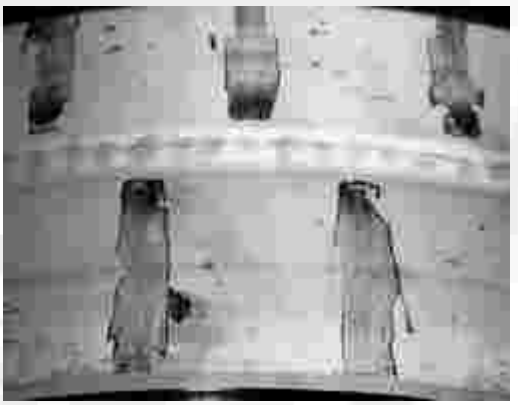


Corrosion / Moisture corrosion

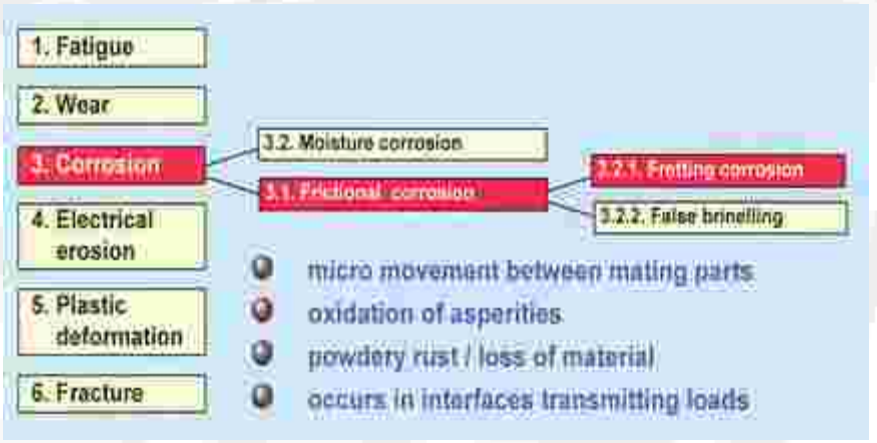


Corrosion / Moisture corrosion

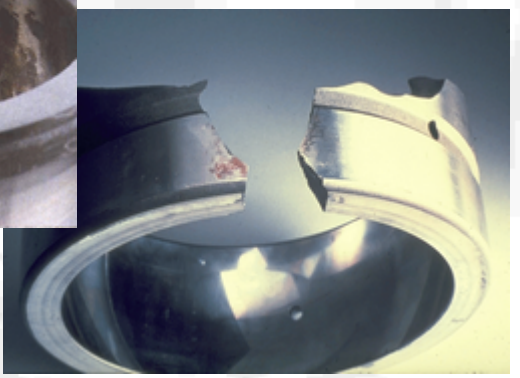




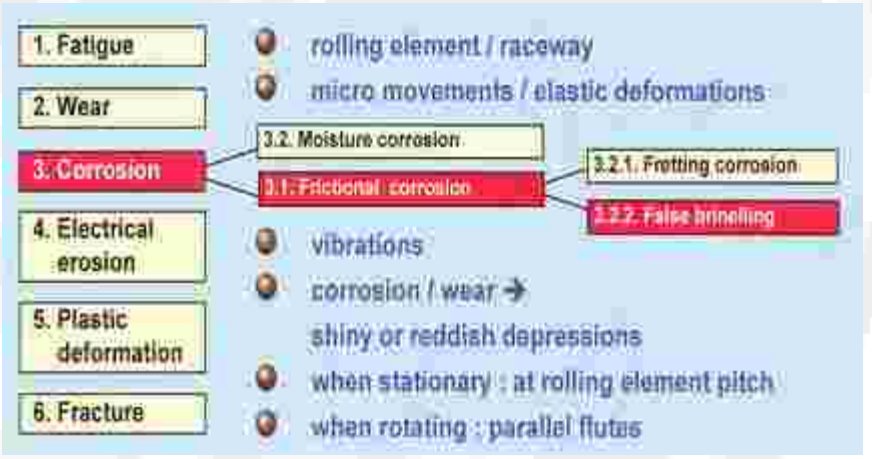
Corrosion / Frictional corrosion (fretting corrosion)



Corrosion / Frictional corrosion (fretting corrosion)



Corrosion / Frictional corrosion (false brinelling)



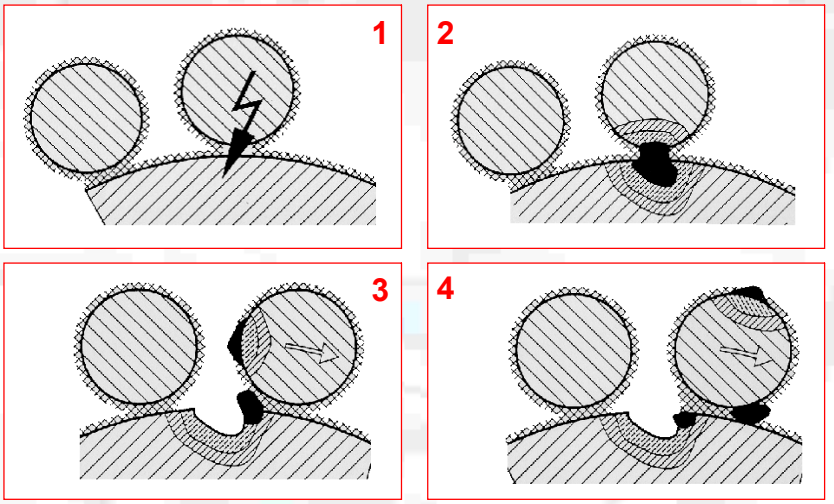
Corrosion / Frictional corrosion (false brinelling)

Electrical erosion / Excessive voltage

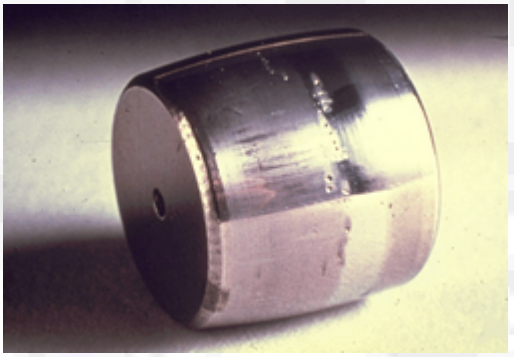
1. Fatigue
2. Wear
3. Corrosion
4. Electrical erosion
   - 4.1. Excessive voltage
   - 4.2. Current leakage
5. Plastic deformation
6. Fracture

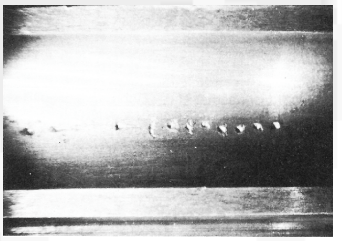
- high current : sparking
- localized heating in very short interval : melting / welding
- craters up to 100 µm

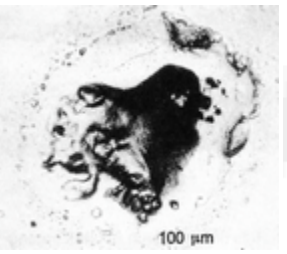
Electrical erosion / Excessive voltage



Electrical erosion / Excessive voltage







Electrical erosion / Current leakage

1. Fatigue
2. Wear
3. Corrosion
4. Electrical erosion
   - 4.1. Excessive voltage
   - 4.2. Current leakage
5. Plastic deformation
6. Fracture

- low current intensity
- shallow craters closely positioned
- development of flutes on raceways and rolling elements, parallel to rolling axis
- dark grey discolouration

Electrical erosion / Current leakage

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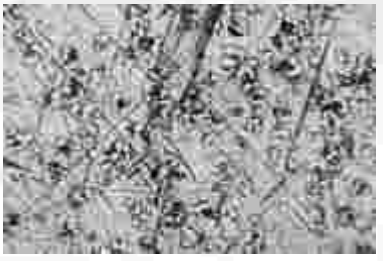
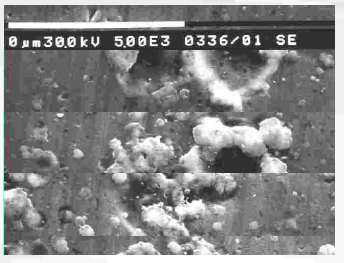
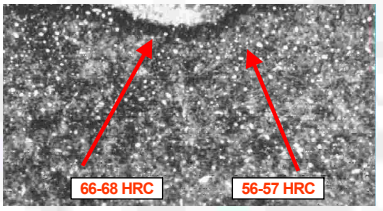
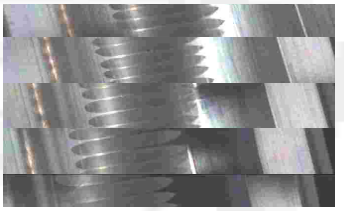
Electrical erosion / Current leakage









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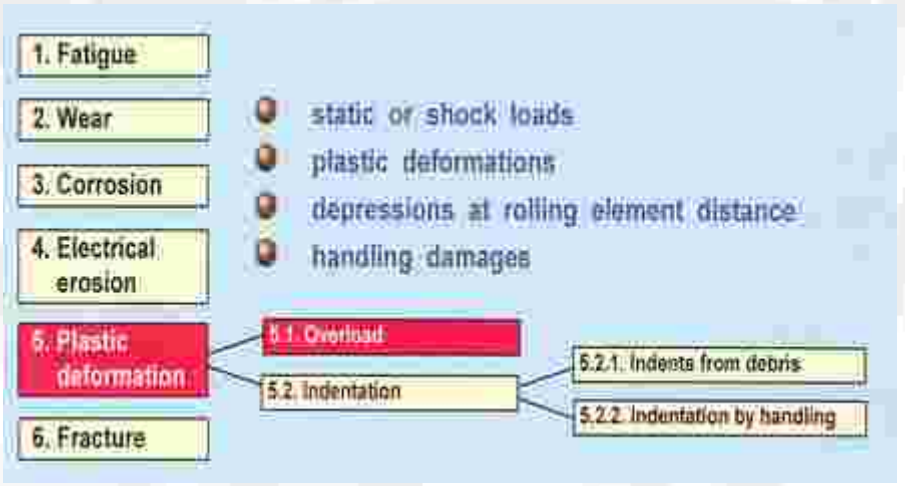
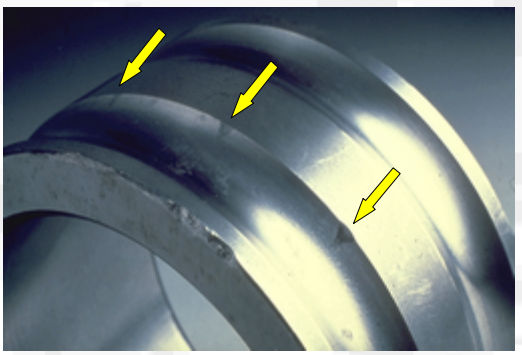
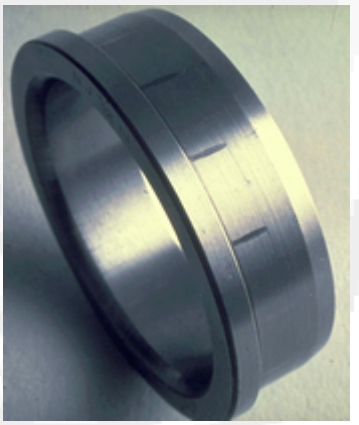
Plastic deformation / Overload



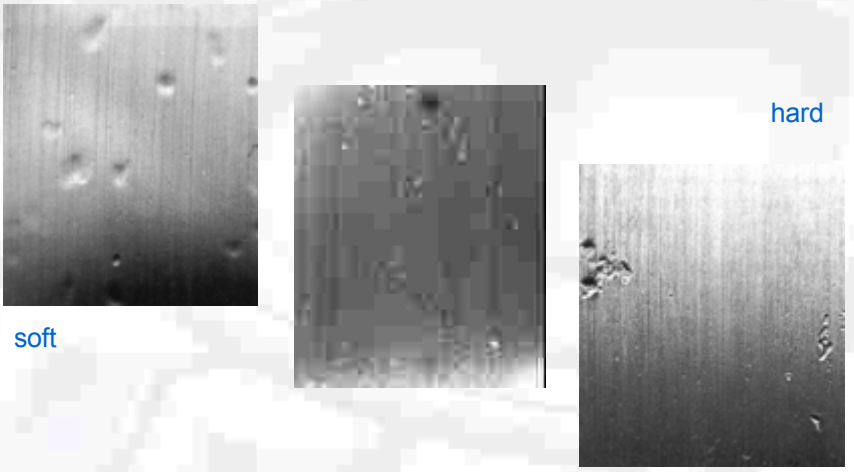
Plastic deformation / Overload



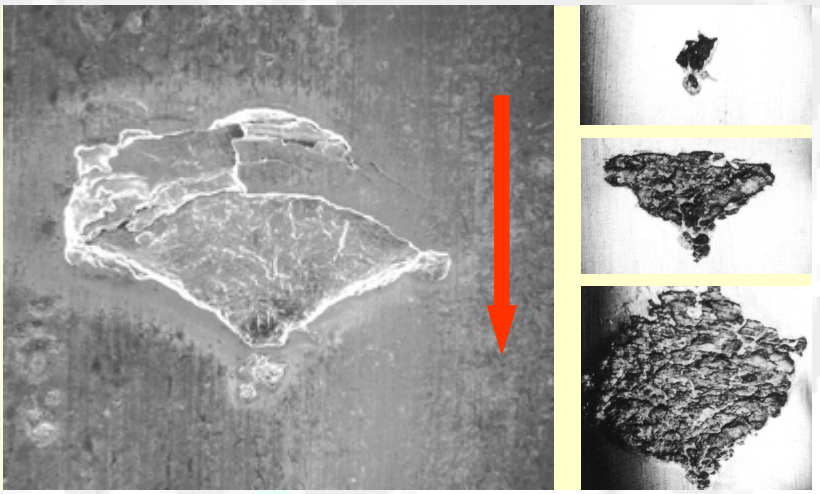


Plastic deformation / Indentation (from debris)

Plastic deformation / Indentation (from debris)



Plastic deformation / Indentation (from debris)



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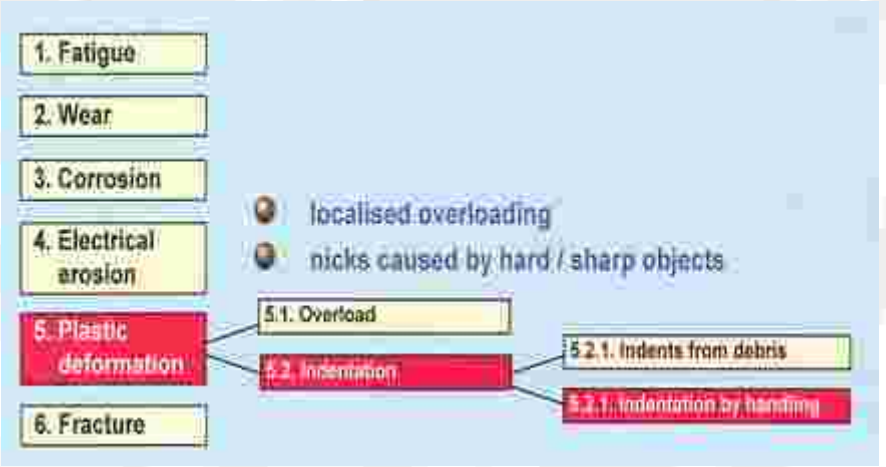
Plastic deformation / Indentation (by handling)



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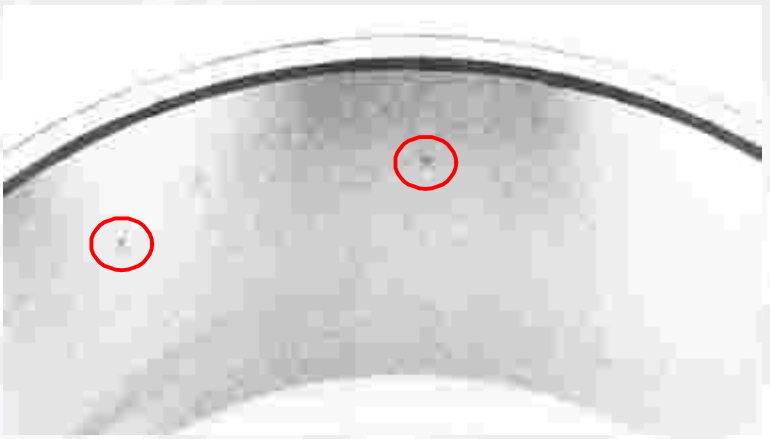
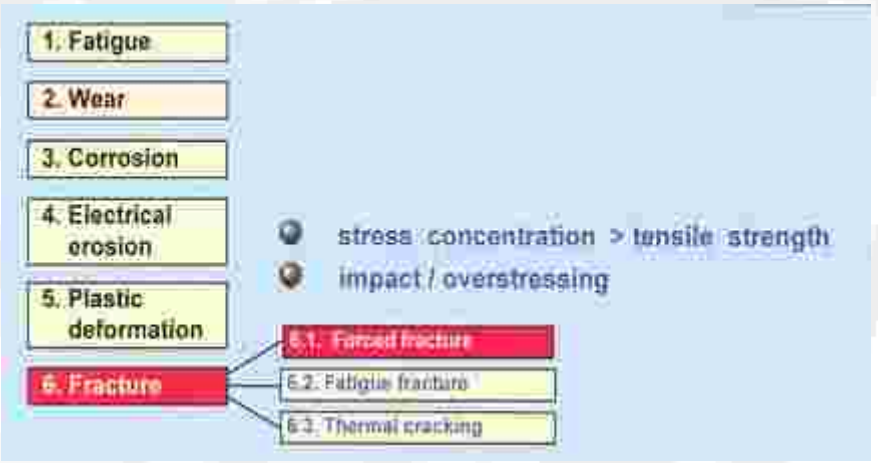
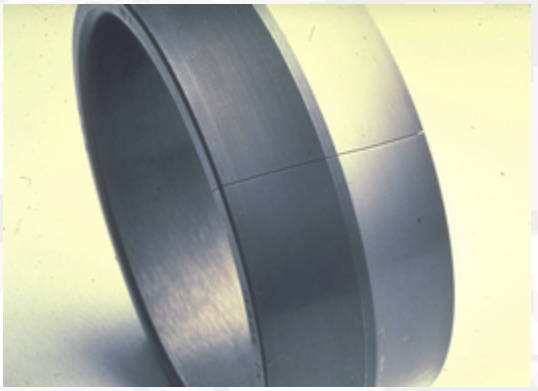
Plastic deformation / Indentation (by handling)

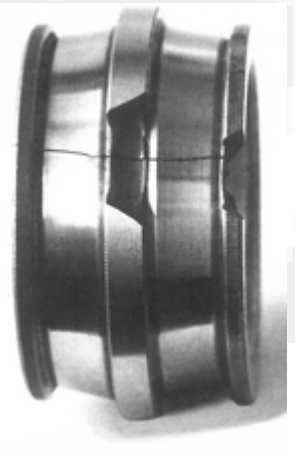


Fracture / Forced fracture



Fracture / Forced fracture





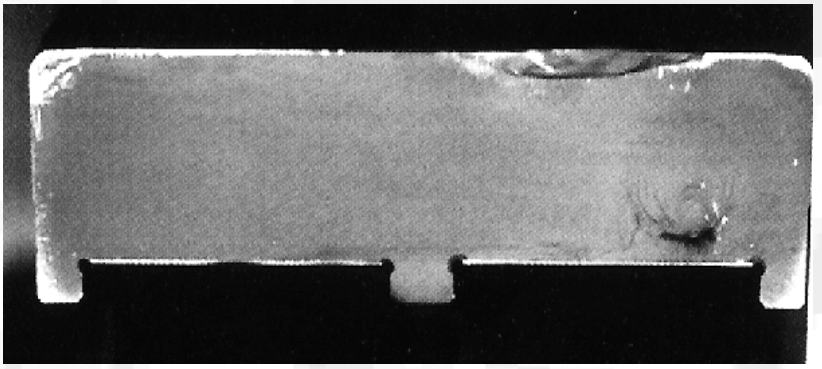
Fracture / Fatigue fracture

1. Fatigue
2. Wear
3. Corrosion
4. Electrical erosion
5. Plastic deformation
6. Fracture

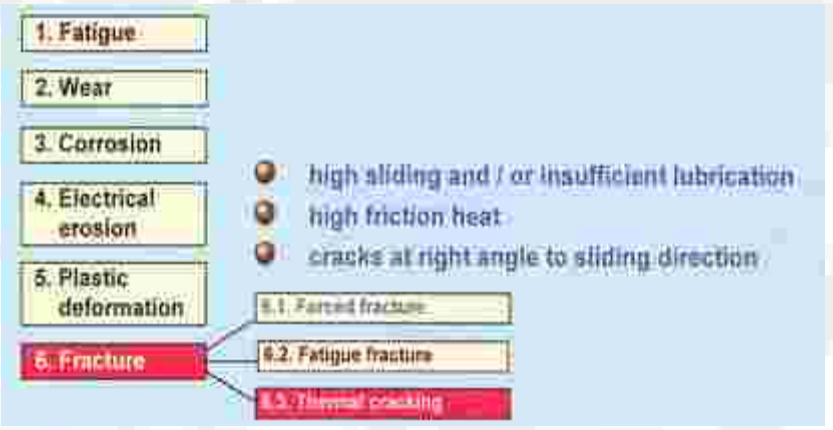
- exceeding fatigue strength under bending
- crack initiation / propagation
- finally forced fracture
- rings and cages

6.1. Forced fracture
6.2. Fatigue fracture
6.3. Thermal cracking

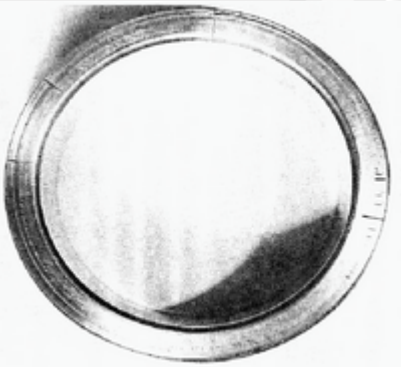
Fracture / Fatigue fracture



Fracture / Thermal cracking



Fracture / Thermal cracking



Conclusie

- Een lagerinspectie laat toe om mogelijke verschillen te kunnen zien tussen de **werkelijke** bedrijfsomstandigheden en de **theoretische** vooropgestelde condities !!

- **Een leidmotief !**:
  Bij elke demontage van lagers is het goed om even tijd te besteden aan een korte inspectie. Aangezien de informatie die gehaald kan worden, is het zeker geen tijdverlies !!