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MOLYKOTE® D-6600 Anti-Friction Coating: A new and innovative coating for highly demanding applications

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October 2018

Transportation & Industrial

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Table of contents

- Technology description
- Product description
- Key features and benefits
- Physical properties
- Application process
- Performance at low-pressure metal tribological contacts
- Performance at medium-pressure metal tribological contacts
- Performance in steel/plastic material pairings
- Corrosion protection characteristics
- Suitable applications

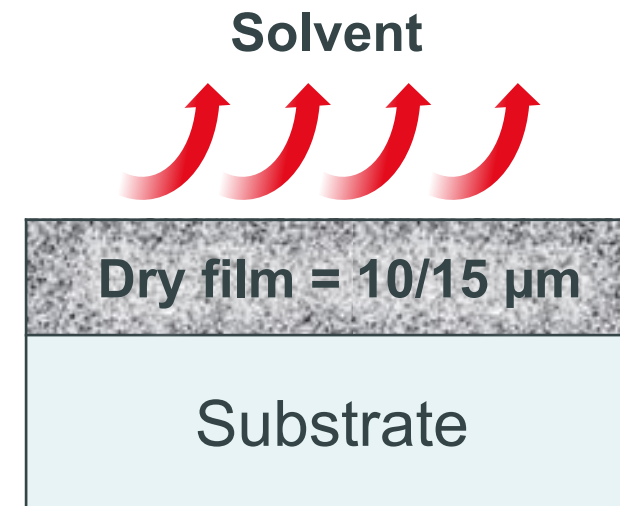
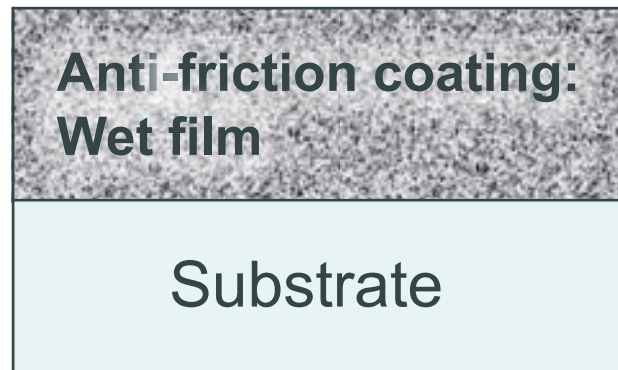


Anti-friction coatings: Technology description

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Dry-film lubricants; bonded coatings, Gleitlacke:

- Organic binder system
- Solid lubricants
- Solvent



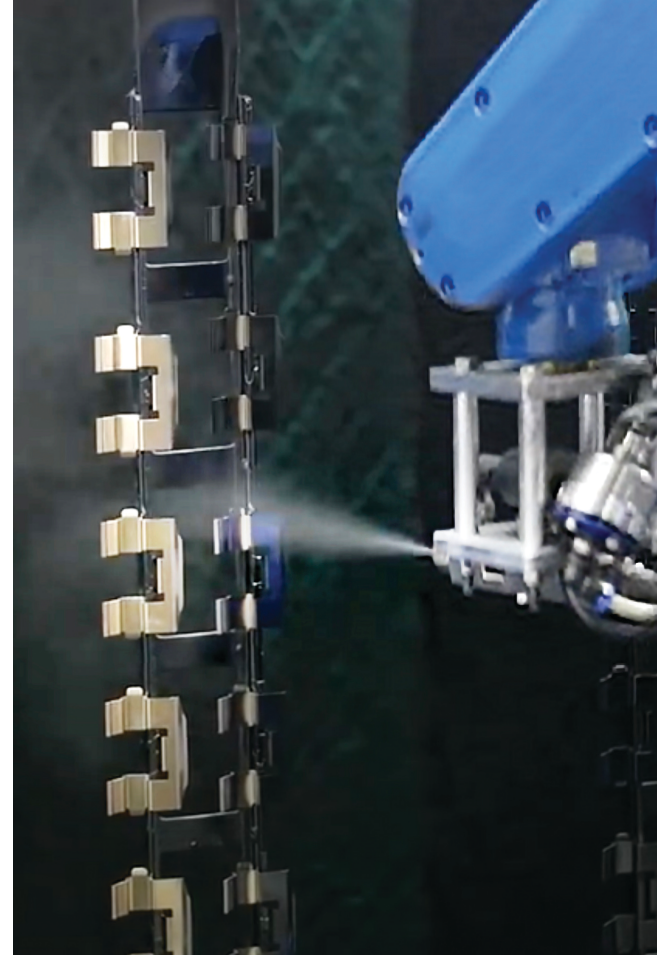
MOLYKOTE® D-6600 Anti-Friction Coating: Product description

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- Polymeric resin system
- Organic solid lubricants
- Solvent

Development target:

Next generation of organic solid lubricants based on anti-friction coating with very low coefficient of friction and extended-service durability



Key features and benefits

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Features

- Excellent dry lubrication properties
- Low COF, especially at medium and low contact pressures
- Excellent load-carrying capacity at medium and low pressures
- Excellent wear protection
- Excellent adhesion to metals
- Low COF for metal/plastic pairings
- Good corrosion protection

Benefits

- Allows service-life dry lubrication of components made of metal/metal material pairings at medium and low contact pressures
- Allows service-life dry lubrication of components made of metal/plastic material pairings
- Allows dry lubrication of components when a fluid (oil/grease) is not desired or not possible

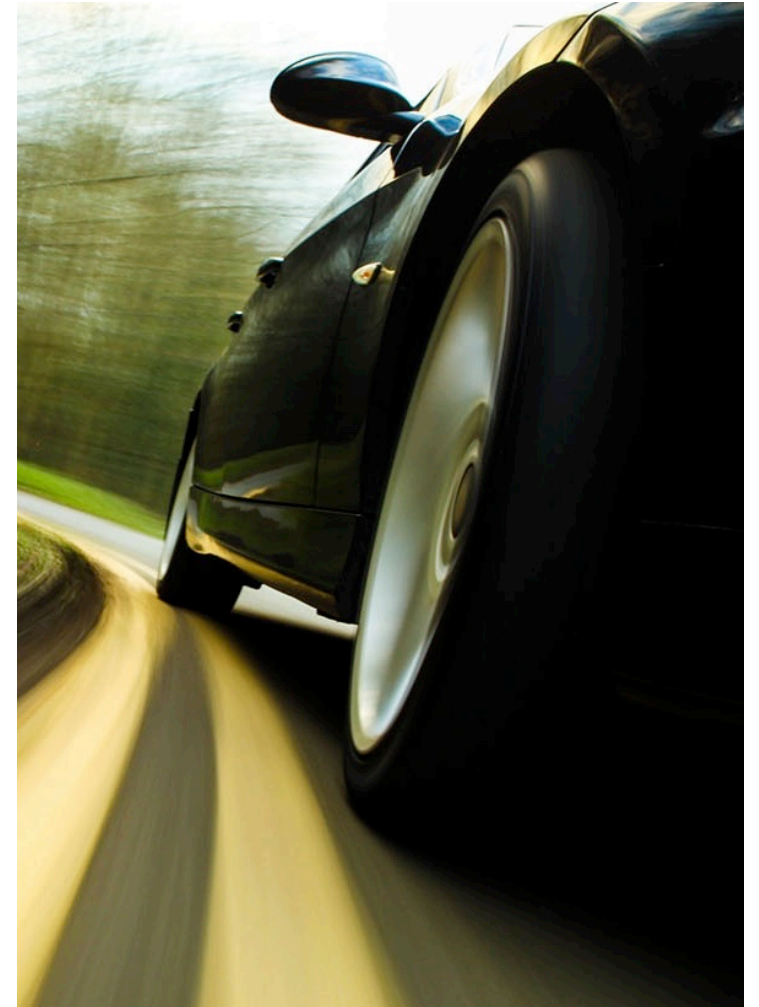


Physical properties

- One-component product
- Flammable material; flash point: 26°C (79°F)
- Color of dry/cured film: yellowish, transparent
- Service temperature range:
-40 to 260°C (-40 to 500°F)
- Viscosity, ISO 2431, cup #4: 35 s
- Nonvolatile content: 26%
- Density of fluid: 0.93 g/ml
- Shelf life: 1 year
 - Tests ongoing to verify/substantiate longer shelf life
 - Target: 2 years

Specification writers: These values are not intended for use in preparing specifications. Please contact your local MOLYKOTE® sales representative prior to writing specifications on this product.

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Application process

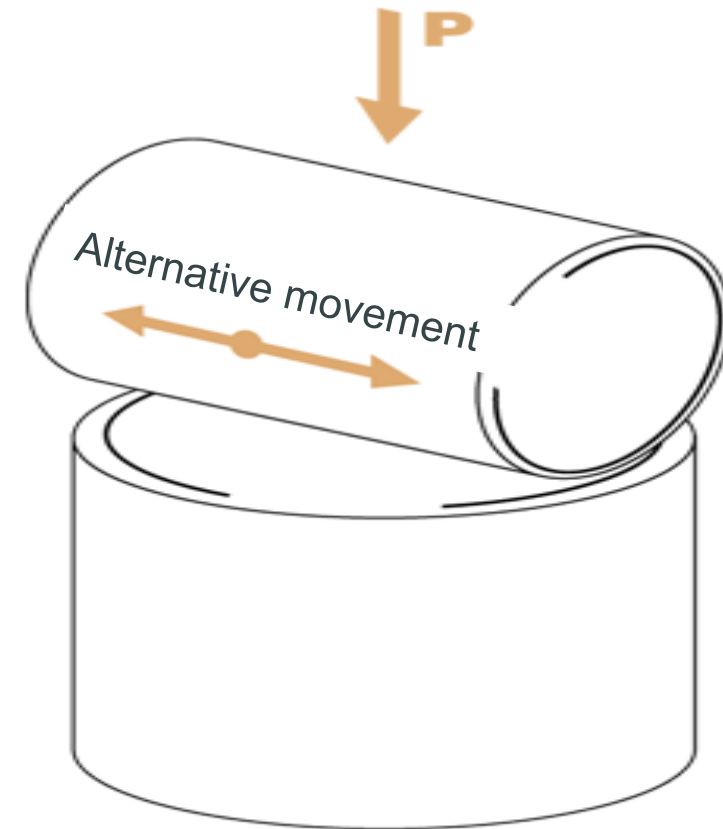
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- Heat curing system; recommended curing schedule is 20 min @ 200°C (object temperature time)
 - Other curing schedules (i.e., reduced curing time) might be possible; need to be tested for each case
- Recommended dry-film thickness: 10-15 µm (AFC typical)
- Preferred application processes:
 - Spraying
 - Dip-spinning (for this process, viscosity might be adjusted according to form and size of parts to be coated)
- Thinner and application equipment cleaner: MOLYKOTE® L-13 Thinner
- Calculated coverage (application process losses excluded): approx. 18 m²/kg at 12 µm dry-film thickness

Low-pressure steel/steel material pairing test: Conditions

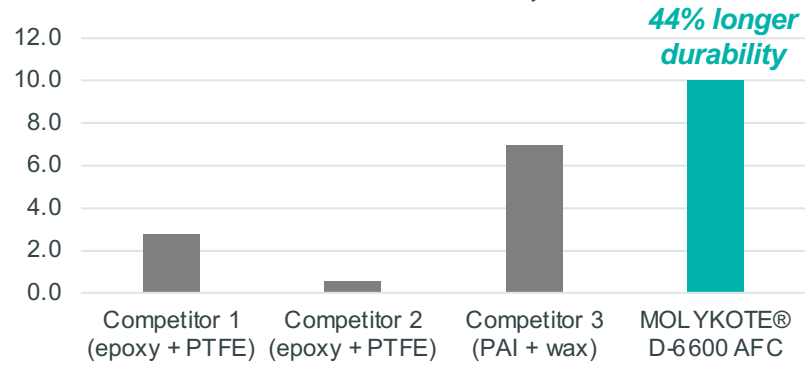
- Durability test
- Simulation of an automotive application

| SRV 5 test conditions | |
|--|---------------------|
| Specimen arrangement | Cylinder vs. disc |
| Movement type | Along cylinder axis |
| Coated specimen | Disc |
| Cylinder material (name = Zylinder-Rolle) | 100Cr6 |
| Disc material (art # 291.150.00, Rz=0.45/0.65) | 100Cr6 |
| Cylinder radius | 7.5 mm |
| Cylinder length | 22 mm |
| A) load corresponding to 100 N/mm² | 45 N |
| SRV stroke | 4 mm |
| SRV cycle stroke | 8 mm |
| Frequency | 40 Hz |
| Speed | 0.32 m/s |
| Test length (corresponding to total sliding path) | 10.4 h |

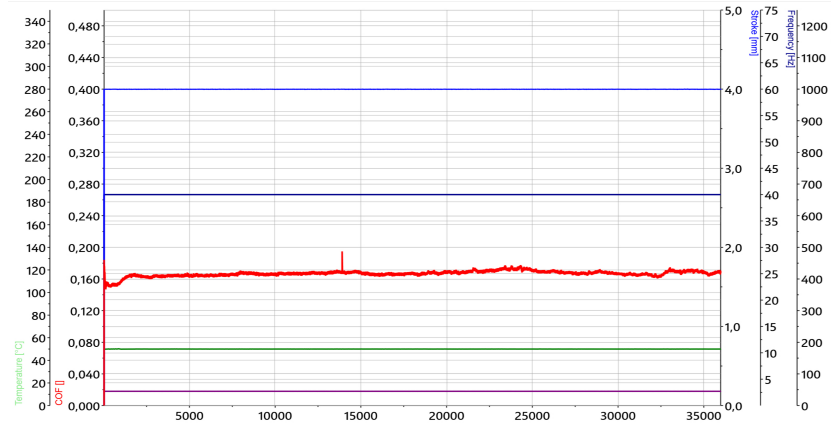
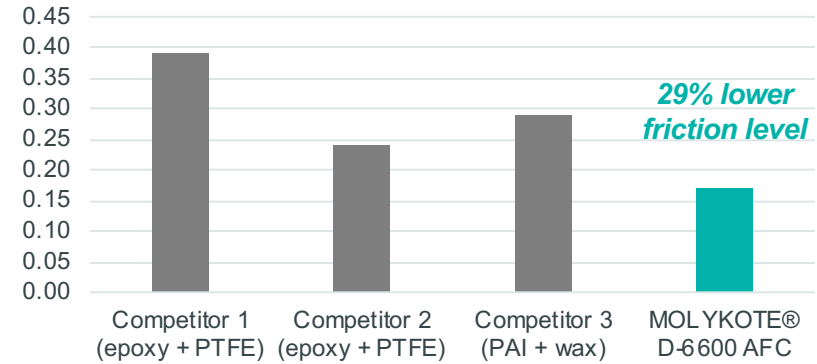


Low-pressure steel/steel material pairing test: Results

SRV durability test:
Time to seizure, h

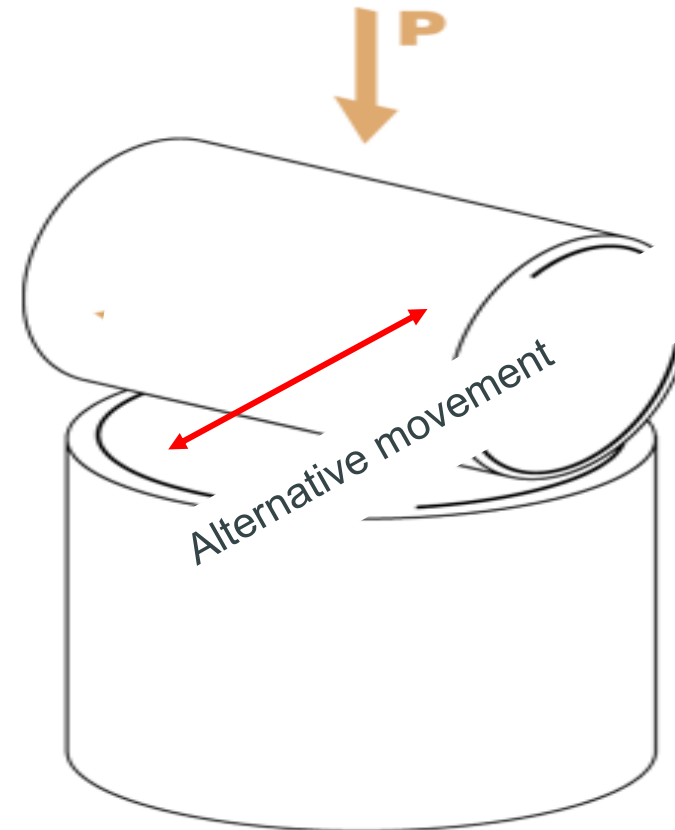


SRV durability test:
Dynamic coefficient of friction



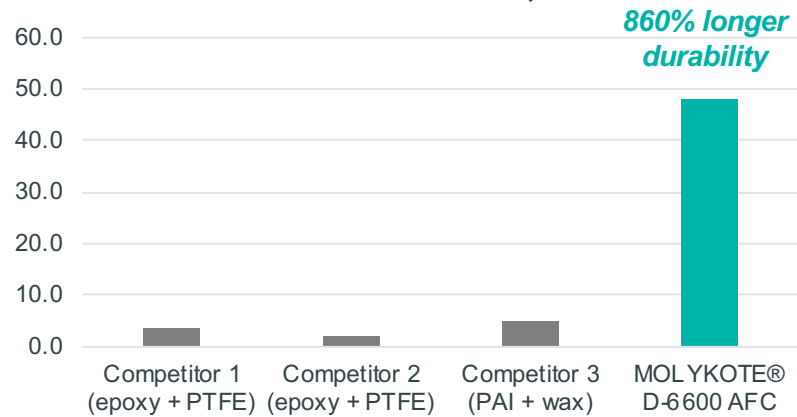
Medium-pressure steel/steel material pairing test: Conditions

- Durability test
- Simulation of an automotive application
- Cylinder (diameter: 11 mm; length: 15 mm)
- Disc (100Cr6)
- Parameters:
 - Stroke: 3 mm
 - Frequency: 25 Hz
 - Load: 130 N
 - Contact pressure (theoretical): 250 MPa
 - Room temperature conditions
 - Dry lubrication (only AFC)
 - AFC applied on disc
 - SRV III DC test machine
 - Pretreatment: Mn-phosphating

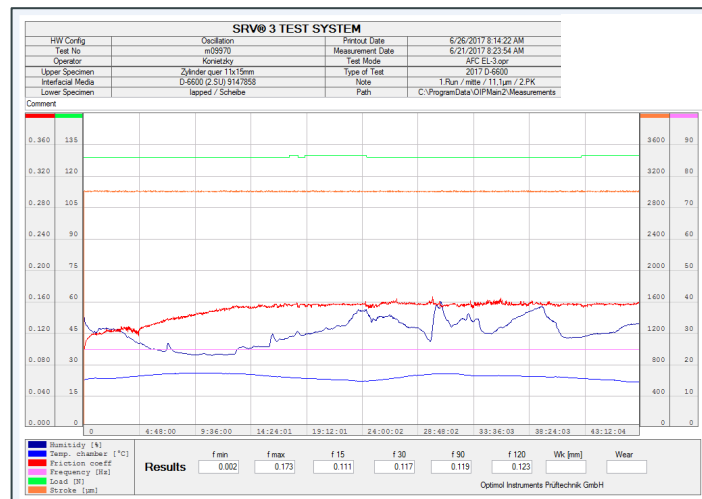
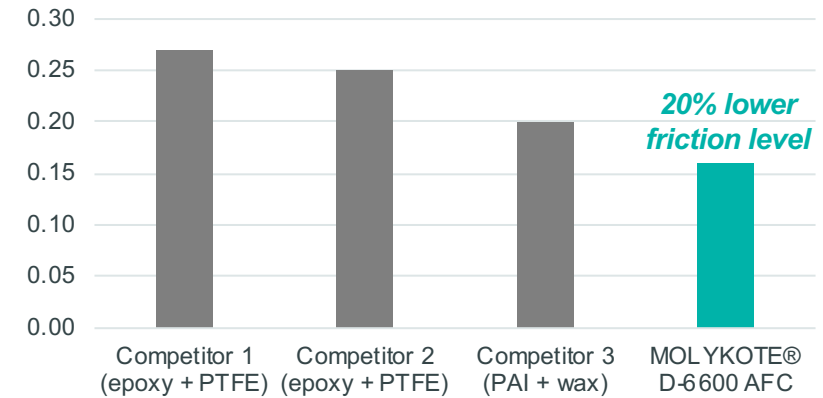


Medium-pressure steel/steel material pairing test: Results

SRV durability test:
Time to seizure, h

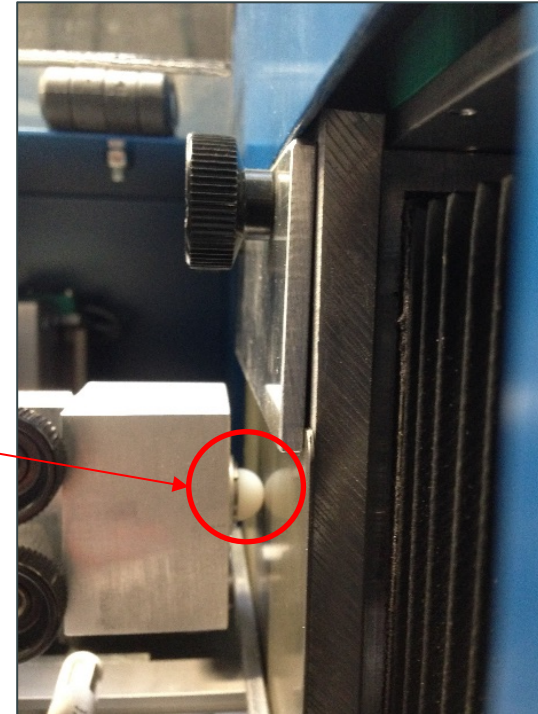


SRV durability test:
Dynamic coefficient of friction



POM/steel material pairing test: Conditions

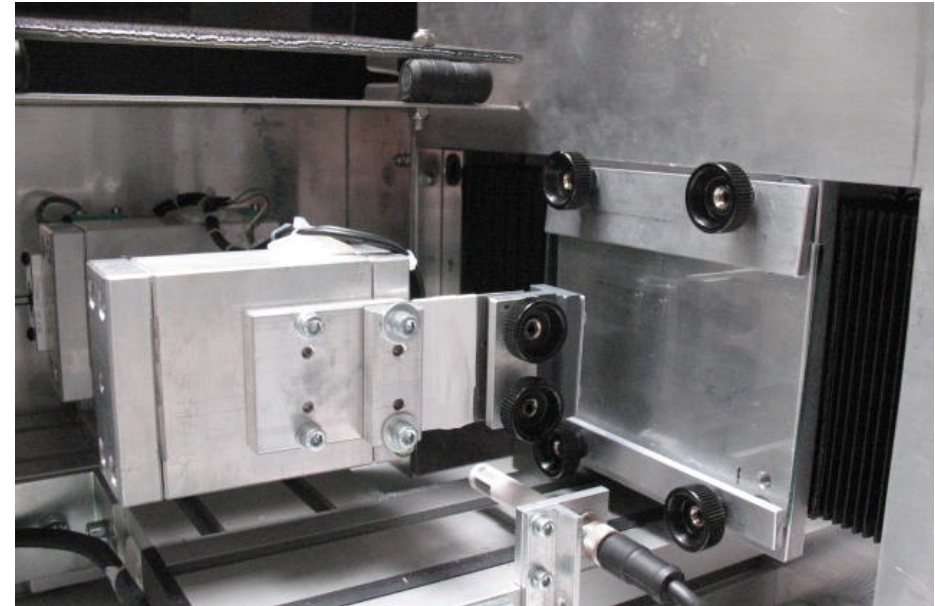
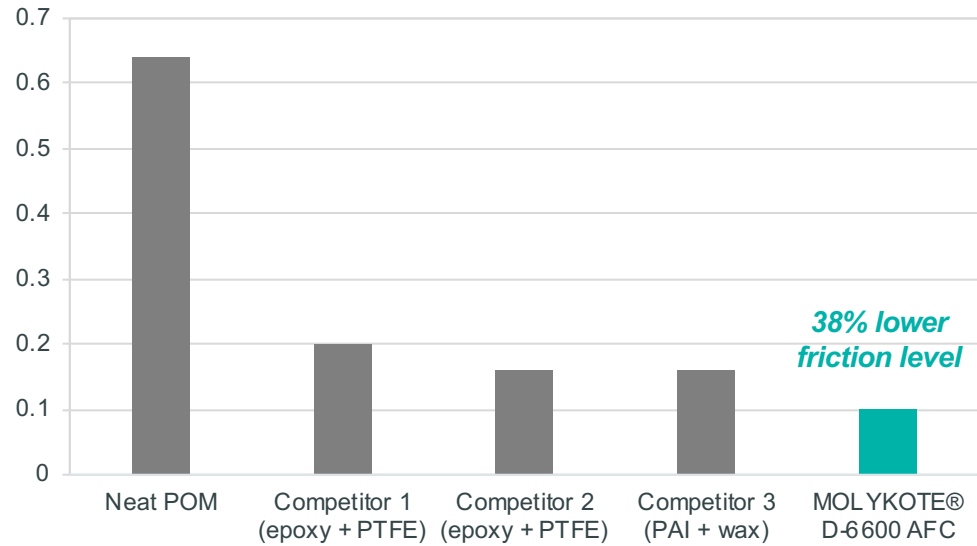
- Anti-noise tester
- As per VDA 230-206 test procedure
- POM vs. coated steel
- Material pairing plastic ball
 - Ball diameter: 12.7 mm
- Stroke: +/- 2.5 mm
- Speed: 2 mm/s
- Load: 30 N
 - POM ball: theoretical pressure: 120 N/mm²
- Climatic conditions: room temperature (23°C, 45% RH)
- Test length: 2,500 cycles (durability test, ca. 4 h)



POM/steel material pairing test: Results

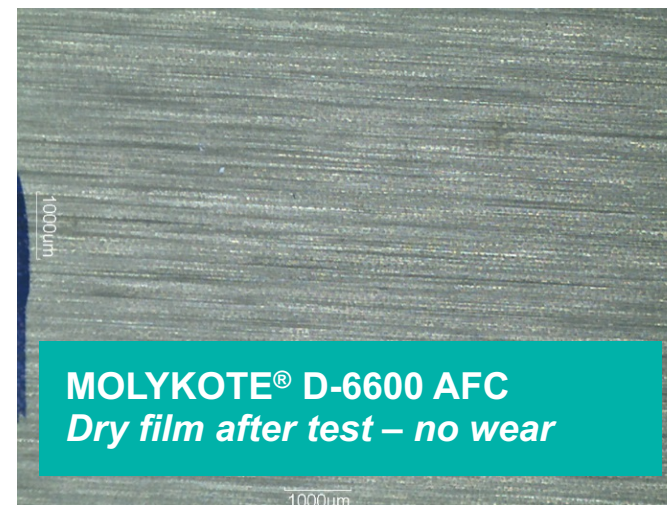
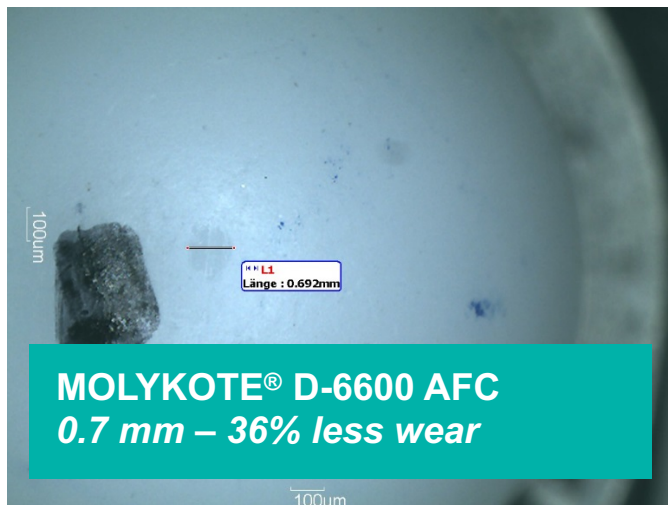
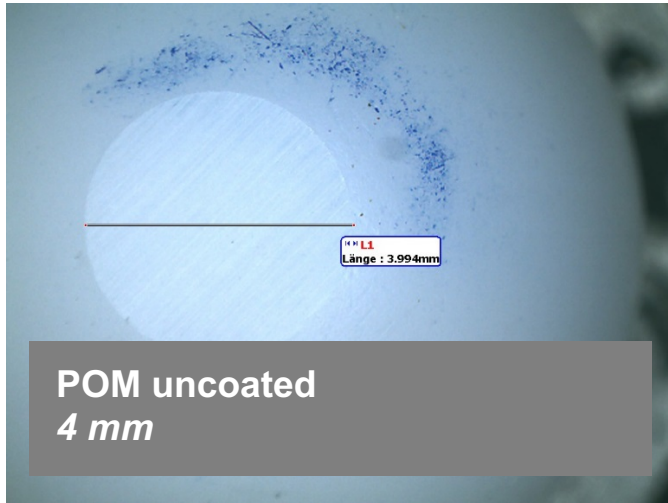
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Anti-noise tester – durability test:
Dynamic coefficient of friction



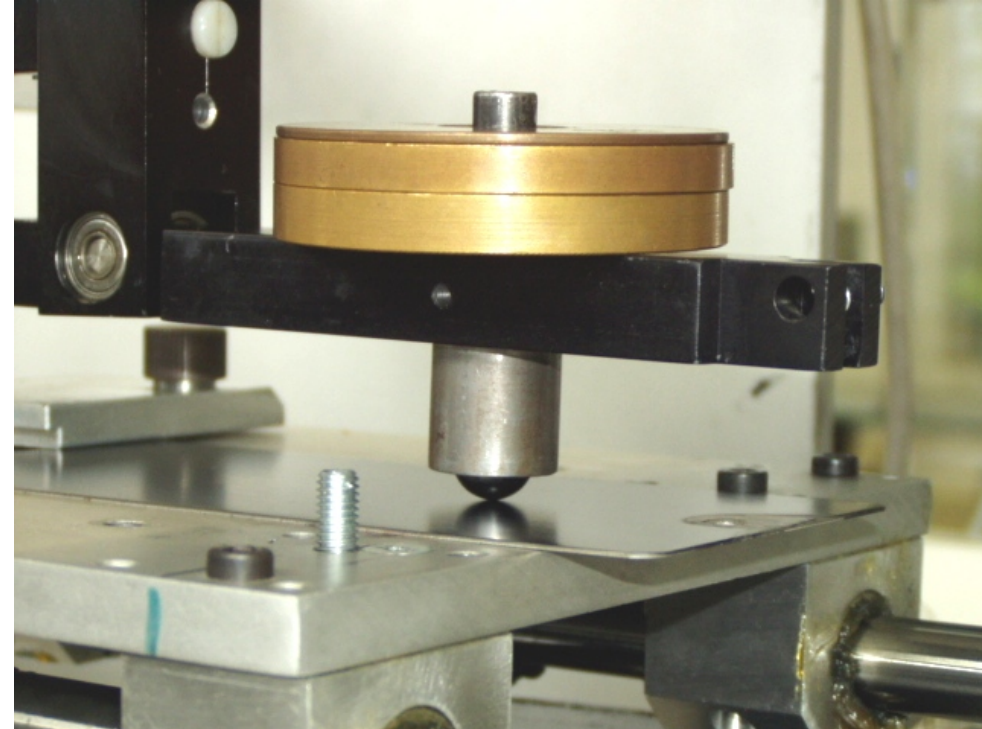
Wear marks – POM ball after test

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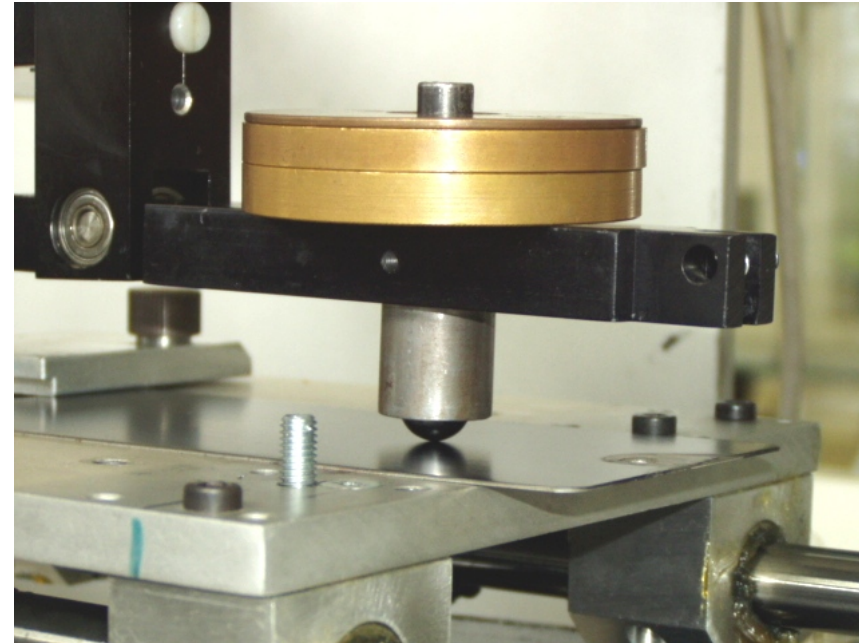
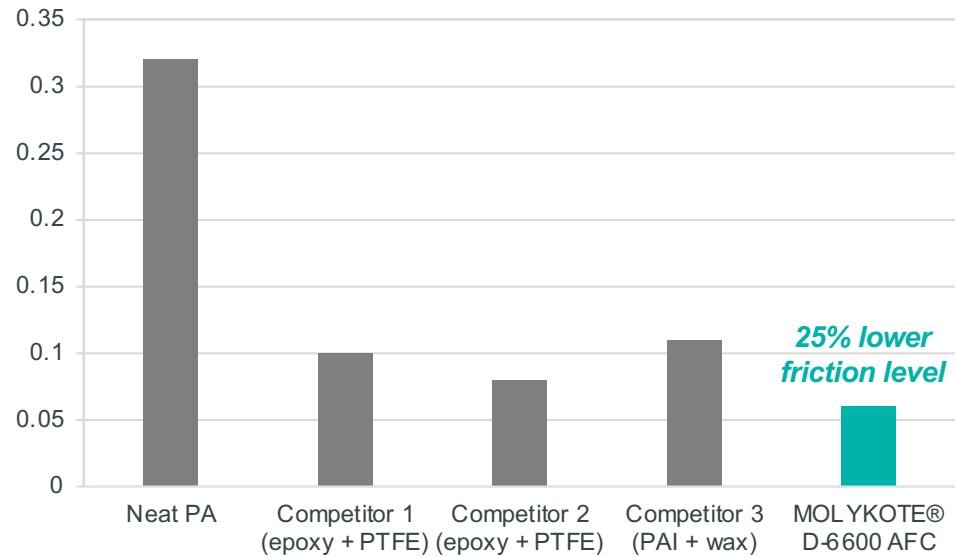
PA/steel material pairing test: Conditions

- Oscillating tester
- PA vs. coated steel
- Material pairing plastic ball
 - Ball diameter: 12.7 mm
- Stroke: +/- 4.5 cm
- Speed: 5 cm/s
- Load: 7 N
 - For PA 6.6 ball: theoretical pressure: 60 N/mm²
- Climatic conditions: room temperature (23°C, 45% RH)
- Test length: durability test, 1 h (1,000 cycles)



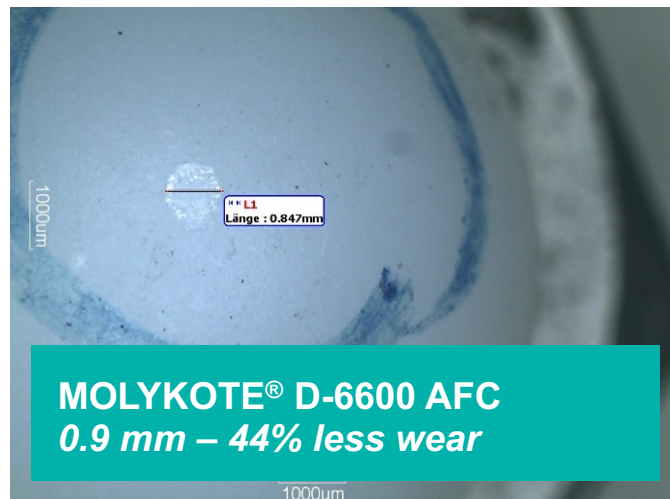
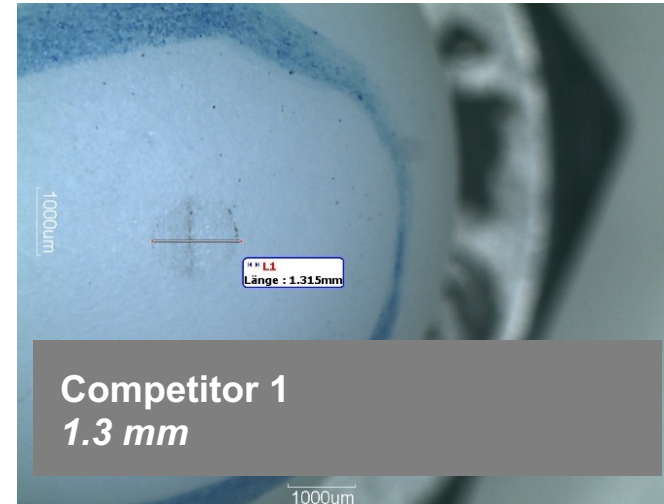
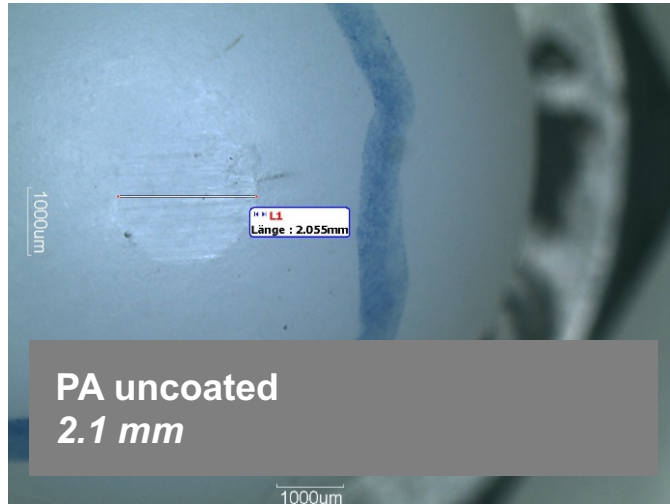
PA/steel material pairing test: Results

Oscillating tester – durability test:
Dynamic coefficient of friction



Wear marks – PA ball after test

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Corrosion protection performance test: Conditions

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- Evaluated with salt-spray testing (ISO 9227)
- The anti-friction coating works under the concept of isolation of coated surface from the environment
- Corrosion protection depends on:
 - Substrate material type
 - Surface pretreatment
 - Form/typology of coated parts (plane, edges, hollow, etc.)
 - Application process
 - Dry-film thickness

Corrosion protection performance test: Results

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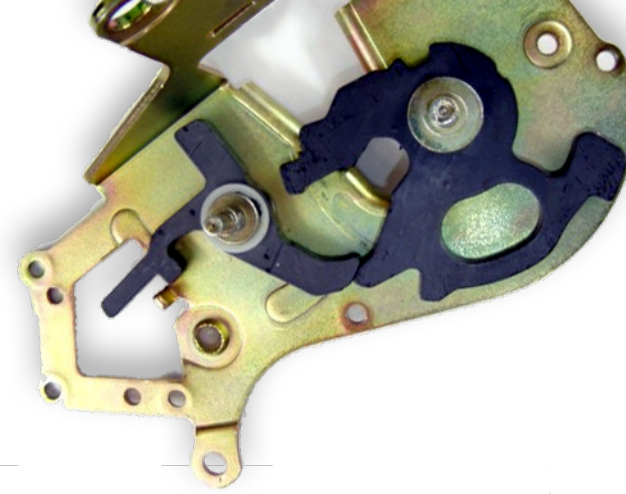
| Steel plane surface |
|-----------------------|
| Zn-phosphating |
| Spraying |
| Film thickness: 13 µm |
| 480 h in SST |

| Lock pawls |
|---------------------------|
| Zn-phosphating |
| Dip-spinning – two layers |
| Film thickness: 12 µm |
| 480 h in SST |

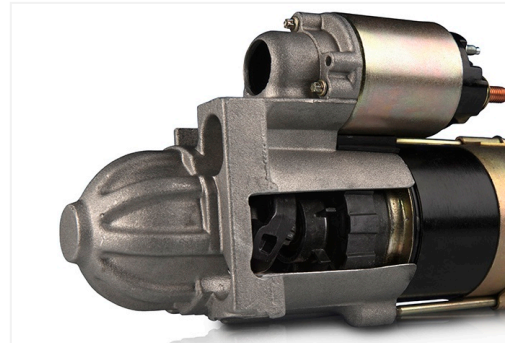


Suitable applications

- Lock components subjected to medium pressures (pawls, catching plate, levers)
- Seat belt system components
- Seating system springs
- Armature cylinders (e.g., starters)
- Suspension system ball joints
- Stainless steel threaded connections



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Key takeaway messages

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MOLYKOTE® D-6600 Anti-Friction Coating:

- Extensively improves service-life dry lubrication of **metal/metal** pairing components under low and medium contact pressures
- Extensively improves service-life dry lubrication of **plastic/metal** pairing components
- Can offer good corrosion protection
- Can be applied to parts using traditional painting application processes and equipment



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Thank you

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