

## X Tribology

### Excellence Centre of Tribology

Programme: COMET – Competence Centers for Excellent Technologies

Program line: K2-Centers

COMET subproject, duration and type of project:

Engine Oils, 04/2015 – 03/2020, multi-firm

## 10,000 km per day – With high-speed to used oil

Lubricants degrade in service. That affects lubrication performance. Component tests often pay insufficient attention to this effect, since used lubricants with adequate reproducibility are not available in sufficient quantity and in a reasonable time. This leads to a component and system design that does not take into account the influence of oil ageing. The large scale artificial alteration device developed by AC<sup>2</sup>T is a fast, environmentally friendly and economical method for producing defined "used" oils for experimental and development purposes. This enables a comprehensive life assessment of the entire lubricated system.

### Bench testing – risk assessment and performance optimization at an early stage of engine development

In modern combustion engines, high-performance components are required for many years of use to ensure cost-effective, environmentally friendly and reliable operation.

A premature failure costs time, money, harms customer trust and might be a potential hazard to people. This must be avoided.

Bench testing of single components or engine test rigs for testing the whole system are crucial tools for the development to assess the mentioned requirements. These tests must simulate the entire life cycle of parts and systems. Identifying and correcting potential errors in the development phase must be carried out under cost-efficient conditions. The shortcoming of such test protocols is that they typically utilize fresh lubricants, therefore disregarding the effects of oil degradation. This potentially leads to false extrapolations of life time performance.

Thus, tests with oils that represent different stages within the oil's life cycle significantly contribute to product reliability and safety.

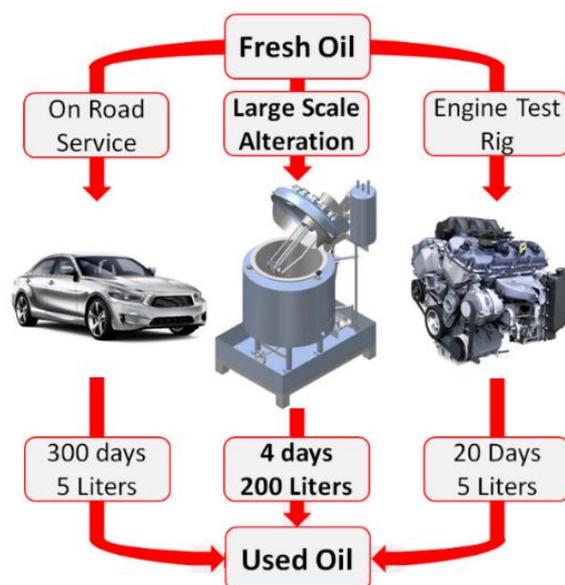


Fig. 1: Time needed to gain the same oil condition  
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### Oil degradation is inevitable

The production of defined “used” oils is challenging, as the loss of lubricant performance in application is influenced by a number of factors, among others:

- oxidation, especially at higher temperature
- loss of wear protection additives
- accumulation of acids leading to corrosion
- contamination from the environment

Each single factor leads to problems that are comparable with faulty part design in an in-service system – and they occur simultaneously.

Due to cost and time issues, it is not reasonable to utilize engine test rigs for oil aging as they produce only small volumes after weeks. Standardized laboratory practices for simulating lubricant life cycles have one limitation: the volume is typically less than 1 litre and, hence, are insufficient for bench tests with a consumption of more than a few litres. Thus, used oils are not available on the market.



### Large-scale oil alteration – the solution for the industry

Our advanced alteration method is capable of

- simulating the entire life cycle behaviour of a lubricant within a few days,
- producing up to 200 litres “used” oil per batch for industrial testing and development purposes, and
- ensuring high reproducibility.

The obtained “used” oils

- are comparable with lab-scale samples and used oils from the real application,
- ensure the reliability of test results, and
- are universally deployable in any kind of lubricated system.

Benefits of the new method comprise

- avoiding the need to run real engines for weeks in the lab or even years on the road,
- cost and development time reduction, and

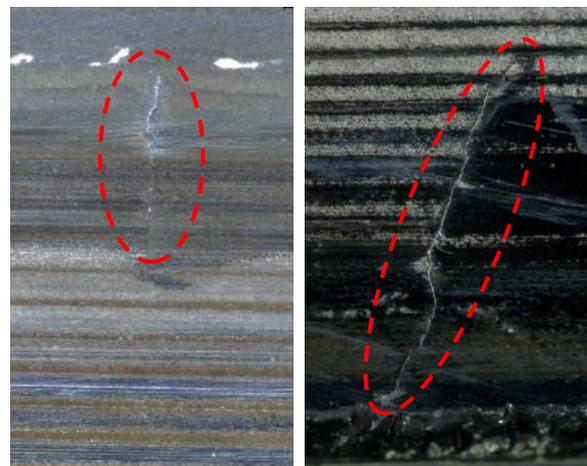
therefore enable a faster market entry.



### Impact and effects

A project partner has successfully utilized oil aged by the large-scale oil alteration to run bearing tests with two fresh and two altered engine oils to evaluate high performance bearings. The required amount of 75 litres per used oil was successfully produced in less than three weeks.

The application of the large-scale artificial alteration of oil saved tremendous amounts of time and resources.



**Fig 2: Comparison of bearing damage with fresh oil after 405,000 cycles (left) and with altered oil after 300,000 cycles (right) – premature and more pronounced failure with altered oil (© courtesy of DAIDO METAL CO. LTD)**

#### Contact and information

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**Further information on COMET – Competence Centers for Excellent Technologies:** [www.ffg.at/comet](http://www.ffg.at/comet)

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