

# Oil Film Pressure at Taper Shape of Piston Pin-bore during Engine Operation

Kunihiko Kobayashi<sup>1)</sup> Wataru Sakurai<sup>1)</sup> Naoki Yamakawa<sup>1)</sup>  
Masakuni Oikawa<sup>2)</sup> Michiyasu Owashi<sup>3)</sup> Yuji Mihara<sup>2)</sup>

1) Art Metal Mfg. Co., Ltd.

2-2-43 Tokiwagi, Ueda, Nagano, 386-0027, Japan (E-mail: kunihiko-kobayashi@art-piston.co.jp)

2) Tokyo City University

1-28-1 Tamazutsumi, Setagaya-ku, Tokyo, 158-8557, Japan

3) Sustainable Engine Research Center Co., Ltd.

4-17-10 Nobuto, Chuo-ku, Chiba, 260-0032, Japan

**KEY WORDS:** Heat engine, Engine component or element, Lubrication/Tribology, Piston, Oil film pressure, Thin-Film sensor [A1]

For piston pin bore, it is important to understand the lubrication condition in order to prevent crack and seizure for piston reliability.

In previous study<sup>(1)</sup>, we measured the oil film pressure distribution at the taper shape of piston pin bore using the thin-film sensor on fatigue rig test and verified the comparison between the result of above test and the elasto-hydrodynamic (EHD) analysis. As a result, the prediction accuracy of EHD analysis needed improvement.

Figure 1 shows the experiment and EHD(present and previous) results of max. oil film pressure on fatigue rig test. We change the input of the pin bore shape and roughness after blending. At 2 to 5mm position, oil film pressure of EHD(present) decrease from previous. At 7mm position, oil film pressure of EHD(present) increase from previous. This is presumed to be effect of the shape and roughness inputs. We are able to improve the prediction accuracy of EHD analysis.

Figure 2 shows the experiment result of oil film pressure at the taper shape of piston pin bore using the thin-film sensor (with Diamond Like Carbon protection film) during engine operation (3000rpm High-load). We are able to measure the oil film pressure at three locations simultaneously, and obtain data to validate the accuracy of the EHD analysis during engine operation.

Figure 3 shows the experiment and EHD results of oil film pressure during engine operation (3000rpm High-load). EHD analysis is able to predict the experimental tendency for the oil film pressure to increase at the peak timing of the cylinder pressure.

## Reference

- (1) Kouta Miura, Kunihiko Kobayashi, Naoki Yamakawa, Mitsuyoshi Saruwatari, Yuji Mihara : Measurement of oil film pressure in piston pin-boss by thin-film pressure sensor, SAE 2015 Powertrains Fuels & Lubricants International Meeting (2015), 2015-01-2040

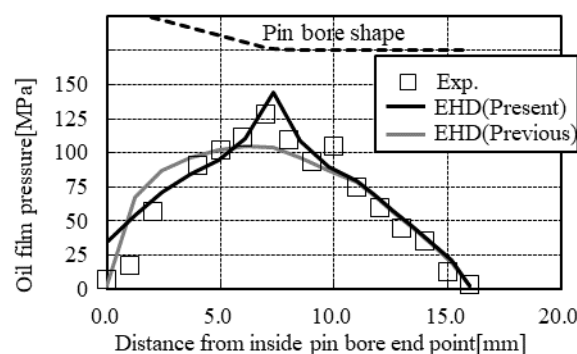


Fig.1 Exp. and EHD result of max.oil film pressure (rig test)

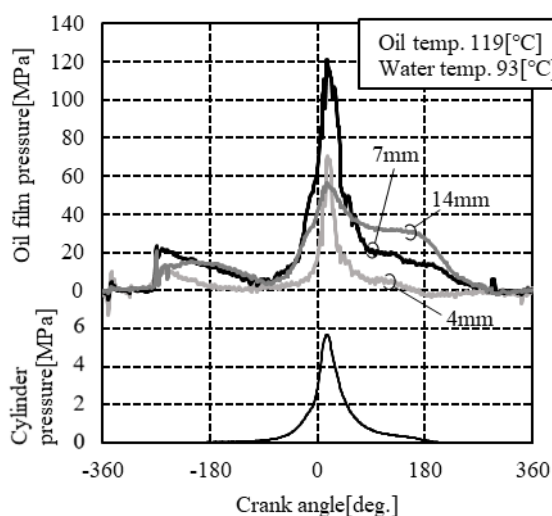


Fig.2 Experiment result of oil film pressure (engine)

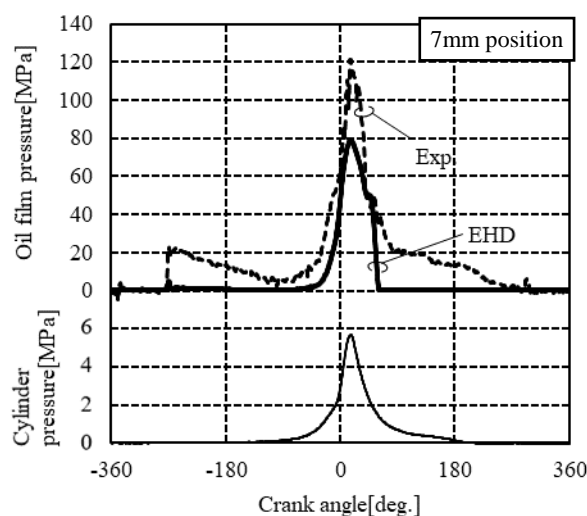


Fig.3 Exp. and EHD result of oil film pressure (engine)