

Laser-Assisted In-Situ Wear Differentiation of Polymer-Polymer Tribological Systems

Accurate wear differentiation of simultaneously wearing polymer counterparts

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Introduction

Traditionally, Ball-on-Prism-Tribometers are used to measure system wear. For our research in additive manufacturing and polymer technology, it is crucial to accurately test polymer-on-polymer wear systems where both counterparts wear, and a second source of information is needed to differentiate between ball- and prism-wear.

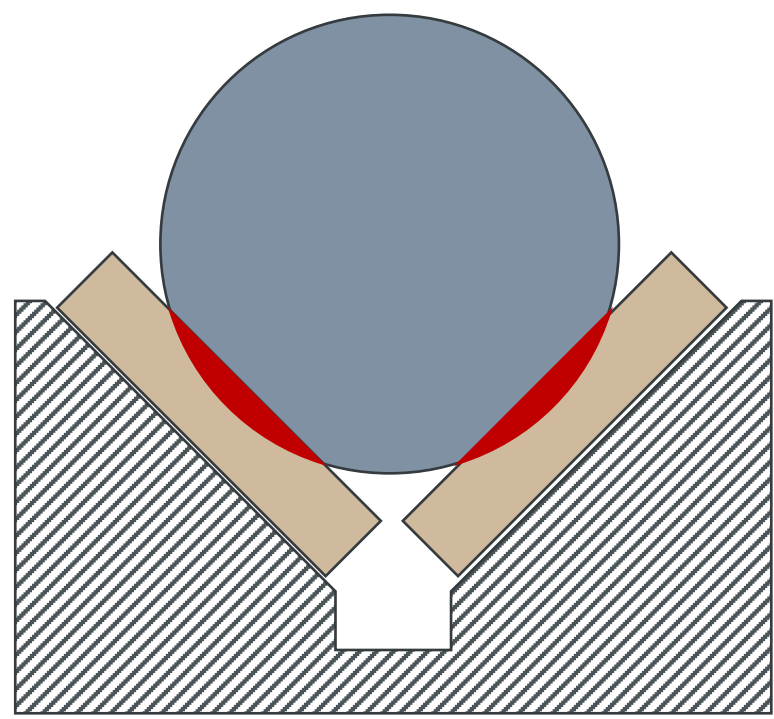


Figure 1: Ball-Prism-Tribometer Cross-Section [1]

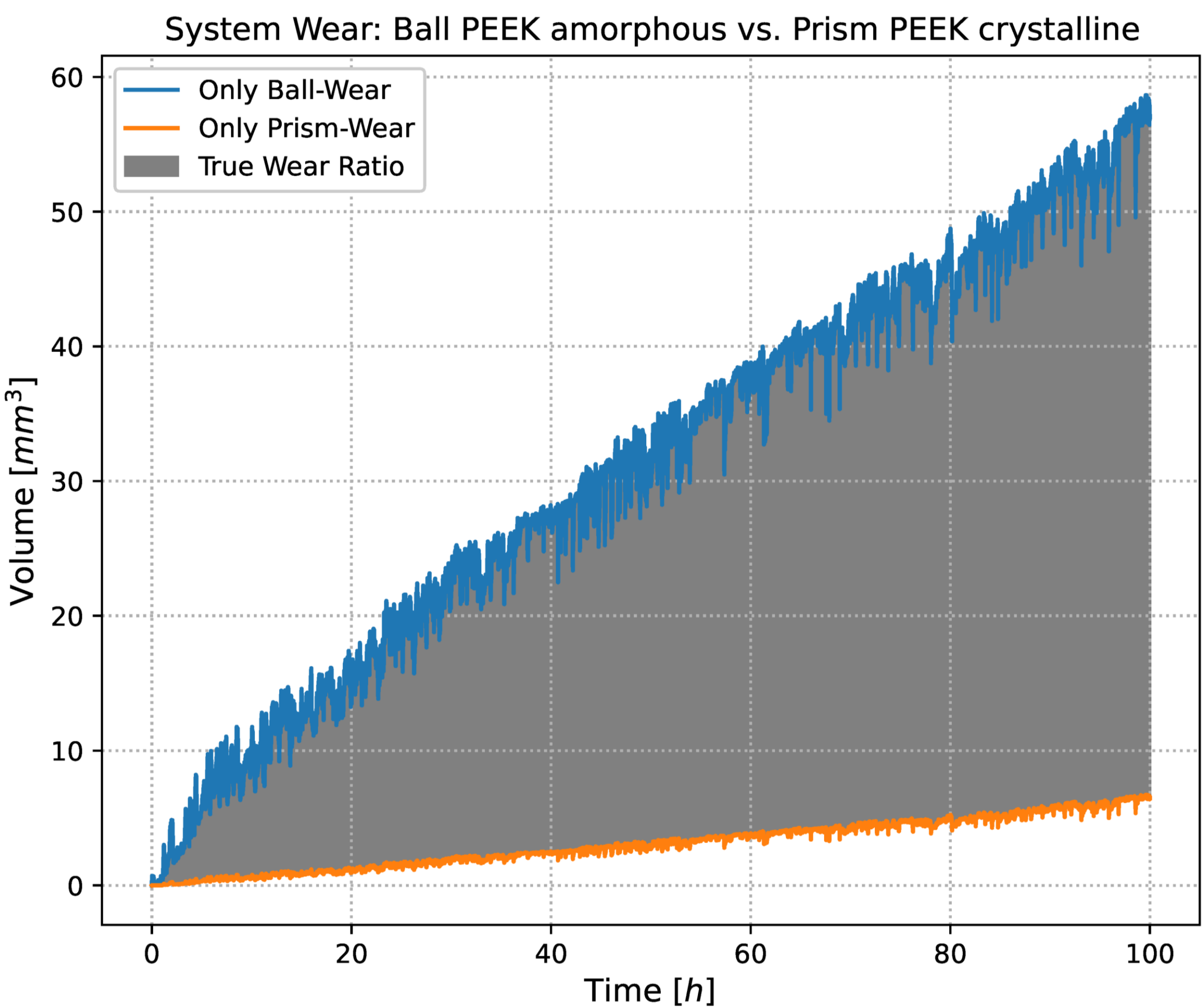


Figure 2: Results of a traditional Wear Measurement

Methodology

To enable an individual calculation of the wear volume of the ball and the prism, a laser line scanner is used to scan the ball’s surface. Together with the indentation depth, the individual wear volume is calculated. A linear axis to move the laser to each of the five available slots for testing. The raw data is filtered for invalid measurements and debris on the ball.

Results

The developed process for measuring polymer-polymer tribosystems enables us to accurately measure the true wear of simultaneously wearing counterparts in a Ball-on-Prism-tribometer.

The noise level of the results - especially for the ball data - is reduced by over 80%.

The setup can measure up to five slots simultaneously to decrease experiment-runtimes.

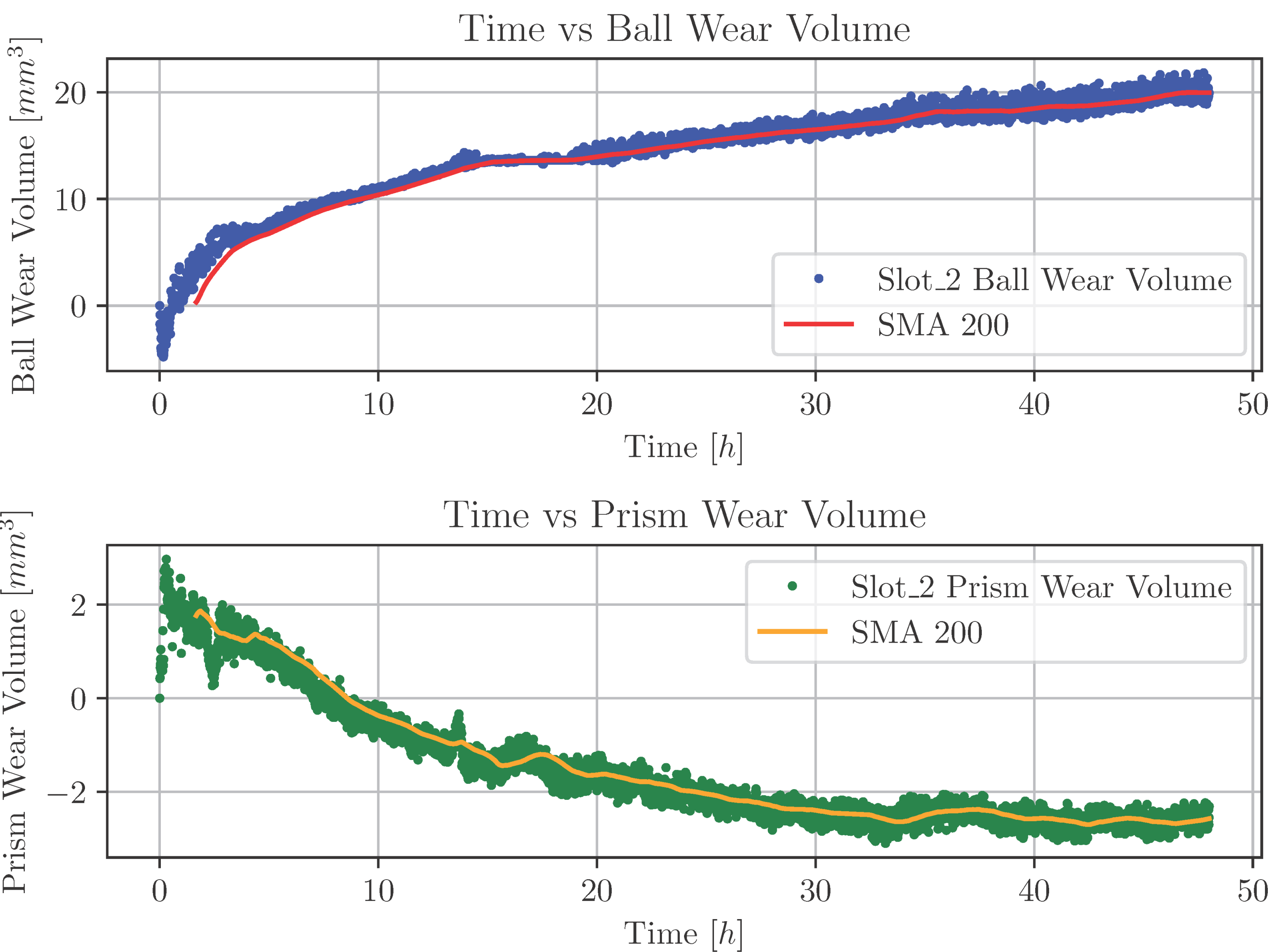


Figure 3: Results of the presented Approach of a 3D Printed Igus I150 Ball on I150 Prisms

What’s next?

The system will be expanded by a thermal imaging setup to measure and analyze the effects of temperature on the wear behavior.

It is planned to develop an AI algorithm for outlier and debris detection.